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ABOUT THIS SPECIAL ISSUE

Oral and systemic health are closely related to each other. oral diseases are potentially associated with different general health conditions. Thereby, an influence of oral conditions on systemic health or vice versa as well as different bidirectional relationships have been uncovered. Moreover, medications can show distinct side effects in the oral cavity, such as xerostomia or gingival overgrowth, or affect the patient's immune system as well as bone metabolism. oral diseases can affect the initiation and progress of various systemic diseases such as cardiovascular, neurological, and respiratory diseases; on the other hand, systemic diseases can increase the susceptibility of suffering from oral diseases. Both oral and systemic diseases share several common risk factors, which contribute to the incidence of both diseases, for example, aging, smoking, alcohol abuse, gender, education and socioeconomic status, and genetic susceptibility.

This Special Issue will focus on these different aspects of oral conditions, dental care, and quality of life in the context of the relationship between oral and systemic health.

SP-1

Protective Effect of Gymnema Sylvestre Ethanolic Extracts on Diabetic Dyslipidemia and Cardiac Tissue in High Fat Diet and Diabetic Induced Wistar Rats.

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Abstract: Diabetes mellitus is the major epidemics affecting worldwide. This multifactorial metabolic disorder characterized by the hyperglycemia, increase insulin resistance and diabetic dyslipidemia resulting metabolic and molecular changes eventually contribute diabetic-related vascular complications. Diabetic dyslipidemia may increase the risk of atherosclerosis and cardiovascular disease. *Gymnema Sylvester* is a known anti-diabetic herb and also have the anti-obesity and cardio protective properties. By virtue of their ameliorating effect, the present is designed to evaluate the protective effect of *Gymnema sylvestre* on diabetic dyslipidemia and cardiac tissue under high fat diet and diabetic induced condition. The animals were divided into six groups (n=6). Group 1: normal pellet diet. Group 2: high fat diet (67.5% lard oil, 31% cholesterol, 1% d1-methionine, 0.3% yeast powder and 0.1% NaCl for entire experimental period. Group 3: administered with streptozotocin (40mg/kg b.w., i.p) for 5 consecutive days to establish Type 2 diabetes. Group 4: diabetic induced and *Gymnema* treated (200mg/kg of b.w. for 3 weeks); Group 5: diabetic induced and *Gymnema* treated (400mg/kg of b.w. for 3 weeks); Group 6: diabetic induced and metformin (25mg/kg b.w. for 3 weeks).Both dosages of *Gymnema sylvestre* restored blood glucose level and body weight in diabetic moel as standard diabetic drug metformin. The high dose *Gymnema sylvestre* normalize the serum lipid profile and reduce pathological changes in cardiac muscles than the lower dose of *Gymnema sylvestre* and metformin. In conclusion, *Gymnema sylvestre* restored blood glucose level as standard diabetic drug metformin. However, high dose of *Gymnema sylvestre* restores the lipid abnormalities and reduce pathological changes of cardiac muscles. The bioactive components Gymnemic acid, present in this herbal drug could be responsible for these ameliorating effects.

Keywords: Diabetes, *Gymnema sylvestre*, diabetic dyslipidemia, cardiac muscle.

INTRODUCTION

Diabetes mellitus is one of the major epidemics affecting worldwide. Diabetes mellitus is a multifactorial metabolic disorder recognized by the hyperglycemia as a result of defective in insulin secretion or insulin insensitivity or both. The etiology of diabetes is multifaceted associated with genetic factors, aging, and change in normal lifestyle etc., [1]. Consumption of high calorie, lack of physical activities, and obesity contribute diabetes mellitus ultimately resulting in damage to many tissues. Basically diabetes mellitus is classified into Type1, Type2 and Gestational diabetes. Type 1 diabetes is caused by pancreatic beta cell destruction resulting impairment of insulin secretion. Type 2 diabetes is mainly a result of insulin resistance. Gestational diabetes denotes glucose intolerance with onset or during pregnancy[2].In type 2 diabetes, chronic hyperglycemia, increasing insulin resistance, and diabetic dyslipidemia all contribute to a variety of metabolic and molecular changes that leading to the development of diabetic-related vascular complications[3]. Diabetic dyslipidemia is characterized by elevated levels of total cholesterol, triglycerides (TGL), small dense LDL particles (LDL), and lower levels of high density lipoprotein cholesterol (HDL-C) in the systemic circulation of diabetic patients[4]. These lipid abnormalities may increase the risk of atherosclerosis and cardiovascular disease[5].*Gymnema Sylvester* commonly known as Sirukurunjan (Tamil) is a very popular anti-diabetic plant traditionally used as a sugar destroyer[6] for centuries. This herbal drug is also used in many ailments such as jaundice[7], asthma, bronchitis[8], appetite suppressant [9]and conjunctivitis[10] and other diseases[11, 12]. In addition to theses, the anti-obesity[13] and cardio protective properties[14] of Gymnema *Sylvester* have been reported. In light of the advantages, the present study is designed to evaluate the protective effect of Gymnema sylvestre on diabetic dyslipidemia and cardiac tissue under high fat diet and type 2 diabetic conditions.

MATERIALS AND METHODS

Adult male Wistar albino rats weighed about 140 to 160g were used for this study, and the animals were maintained under controlled conditions of a 12:12 hour light/dark cycle with a temperature of 22-25 degrees with a relative humidity of 50-60%. Animals were allowed access standard rat pellet diet and drinking water ad libitum. This study protocol was conducted in accordance with the standard of the Institutional Animal Ethical Committee (CPCSEA no. SU/CLATR/IAEC/XI/100/2018).

Experimental protocol

The animals were divided into six groups and each group consists of six animals. Group 1 is the control animals fed with normal pellet diet. Remaining groups received a high-fat diet, for the first 14 days. Group 2 animals were fed with high fat diet (67.5% lard oil, 31% cholesterol, 1% d1-methionine, 0.3% yeast powder and 0.1% NaCl for entire experimental period (42 days). Group 3 administered with streptozotocin (40mg/kg b.w., i.p) for 5 consecutive days to establish Type 2 diabetic model. The Group 4 and Group 5 were diabetic induced animals and treated with ethanolic extract of *Gymnema sylvestre* by gavage at low dosage (200mg/kg of b.w. for 3 weeks) and high dosage (400mg/kg of b.w. for 3 weeks) respectively. Group 6 is positive control animal, induced Type 2 diabetes with Streptozotocin and treated with metformin (25mg/kg b.w. for 3 weeks).During

the experimental period, the animal weight and the blood glucose level were carefully monitored and recorded. The glucose level was diagnosed by collecting the blood sample from the tail vein and determined by using a glucose analyzer with a glucose strip inserted in the glucometer. At the end of the experimental period, the animals were sacrificed under deep anesthesia by over dose of ketamine (i.p.). The organs such as the liver, kidney, pancreas, heart, and aorta were dissected and weighted immediately. The tissue was fixed in 10% formalin for histological analysis. The animals were trans-cardially perfused using 10% formals saline. Organs were dissected out and post fixed 10% formalin for histological studies.

Serum lipid profile

Blood was collected in EDTA coated test tubes to prevent clotting of blood. These tubes were centrifuged at 2500 rpm for 15 min for separation of plasma. Blood was also collected in separate tubes and was allowed to clot for 20 min for serum separation. The clotted blood was centrifuged at 2500 rpm for 15 min for separation of serum. The separated serum samples were subjected to serum lipid profiles such as HDL (High-density lipids), LDL(low-density lipids), VLDL(very low-density lipids),TGL (Triglycerides) and Total cholesterol. The test samples and standards samples were fed into the autoanalyser (Hitachi 912) after programming for cholesterol. All procedures were performed following the manufacturer's instructions. The results are printed out. The cholesterol levels were expressed as mg /dl.

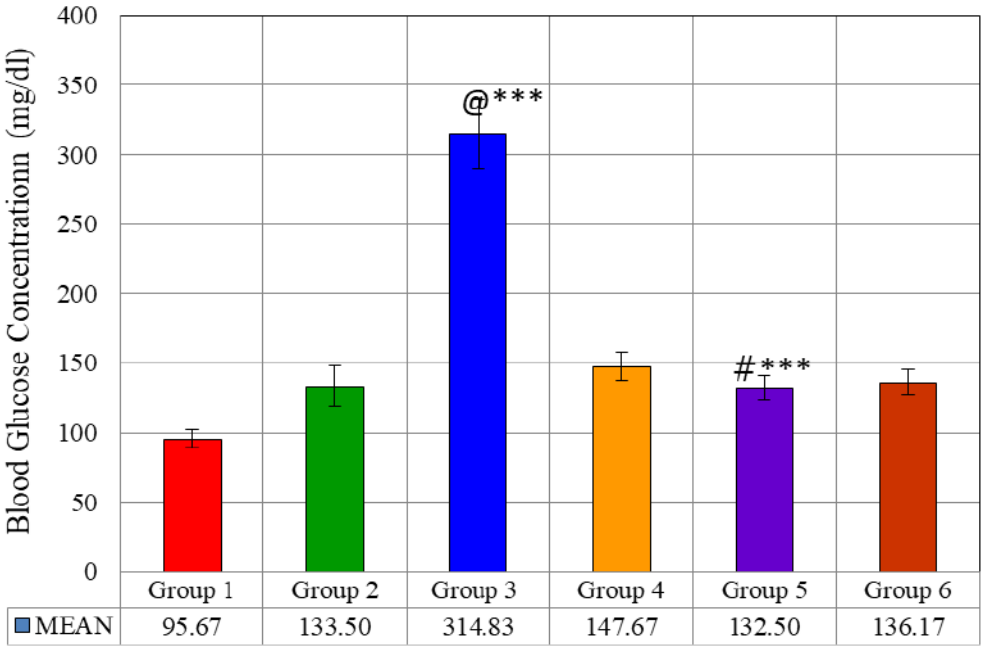
Histological study

Formalin fixed cardiac tissue were processed for routine histology and the sections were taken at 5 µm thickness using rotary microtome and stained with haematoxylin and eosin[15].

STATISTICAL ANALYSIS

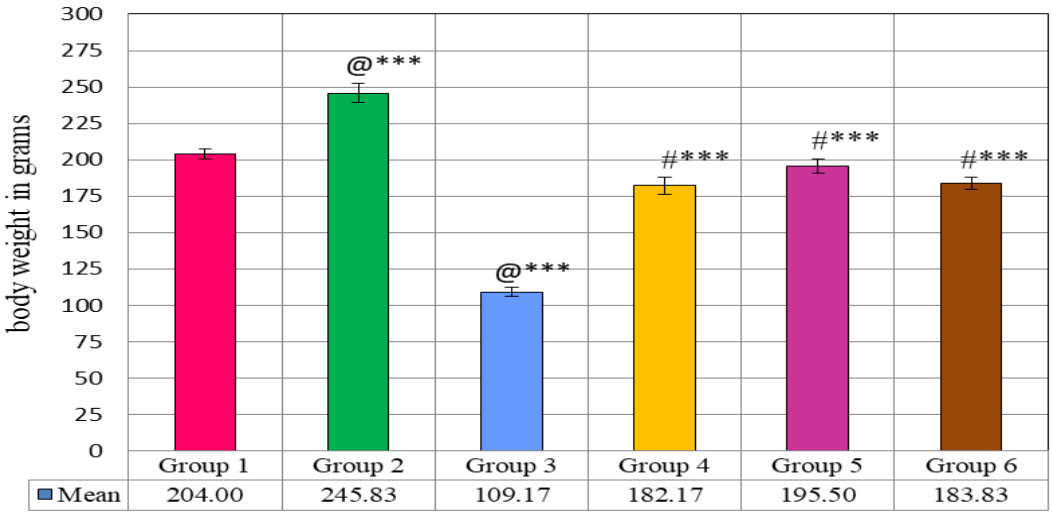
Data were analyzed using Microsoft Excel (Version 2003) and SPSS (SPSS, Version 25 Inc., IBM) software. The values were expressed as the Mean ± SE. One-way ANOVA was performed in SPSS, the level of significance was determined with a "Tukey's posthoc" test and P Values <0.05 was considered as statistically significant.

Blood glucose level



Graph 1 demonstrates blood glucose level control and experimental groups. and each column represents Mean and error bar represents Standard error of mean (n = 6 animals each) with * P<0.05, ** P<0.01 and *** P<0.001 sgnificance. @ - compared with control; #- compared with streptozotocin-induced diabetes. Group 1 - control; Group 2 - High fat diet; Group 3 - streptozotocin-induced diabetes; Group 4 - streptozotocin-induced diabetes + *Gymnema sylvestre* 200 mg/kg; Group 5 - streptozotocin-induced diabetes + *Gymnema sylvestre* 400 mg/kg; Group 6- streptozotocin-induced diabetes + Metformin.

Body Weight of the Animals



Graph 2 illustrates body weight of control and various experimental groups. The values are presented as Mean ± SEM (n=6 animals each) with * P<0.05, ** P<0.01 and *** P<0.001 significance. @ - compared with control; #- compared with streptozotocin-induced diabetes. Group 1 - control; Group 2 - High fat diet; Group 3 - streptozotocin-induced diabetes; Group 4 - streptozotocin-induced diabetes + *Gymnema sylvestre* 200 mg/kg; Group 5 - streptozotocin-induced diabetes + *Gymnema sylvestre* 400 mg/kg; Group 6- streptozotocin-induced diabetes + Metformin.

Serum lipid profile

	Group I	Group II	Group III	Group IV	Group V	Group VI
HDL (mg/dl)	12.5 ± 0.43	16 ± 0.58 #***	10.83 ± 0.48@*	13.5 ± 0.76#*	13.33 ± 0.49#*	13.17 ± 0.60
LDL (mg/dl)	26.41 ± 2.94	38.89 ± 2.00	30.88 ±3.55	28.27 ± 4.64	28.42 ± 4.03	27.83 ± 2.87
VLDL (mg/dl)	6.77 ± 0.49	18.14 ± 3.17@**	11.44 ±1.95	9.89 ± 1.73	8.79 ± 0.88	9.47 ± 1.42
TGL (mg/dl)	32.82 ± 2.76	61.33 ± 9.84	59.37 ±10.89	41.12 ± 5.08	42.77 ± 3.94	46.18 ± 7.63
Total Cholesterol (mg/dl)	51.57 ± 3.14	77.43 ± 7.65	64.29 ± 8.21	49.53 ± 5.90	54.65 ± 3.74	51.67 ± 6.69

Table illustrates serum lipid profile of control and various experimental groups. The values are presented as Mean ± SEM (n=6 animals each) with * P<0.05, ** P<0.01 and *** P<0.001 significance. @ - compared with control; #- compared with streptozotocin-induced diabetes. Group 1 - control; Group 2 - High fat diet; Group 3 - streptozotocin-induced diabetes; Group 4 - streptozotocin-induced diabetes + *Gymnema sylvestre* 200 mg/kg; Group 5 - streptozotocin-induced diabetes + *Gymnema sylvestre* 400 mg/kg; Group 6- streptozotocin-induced diabetes + Metformin.

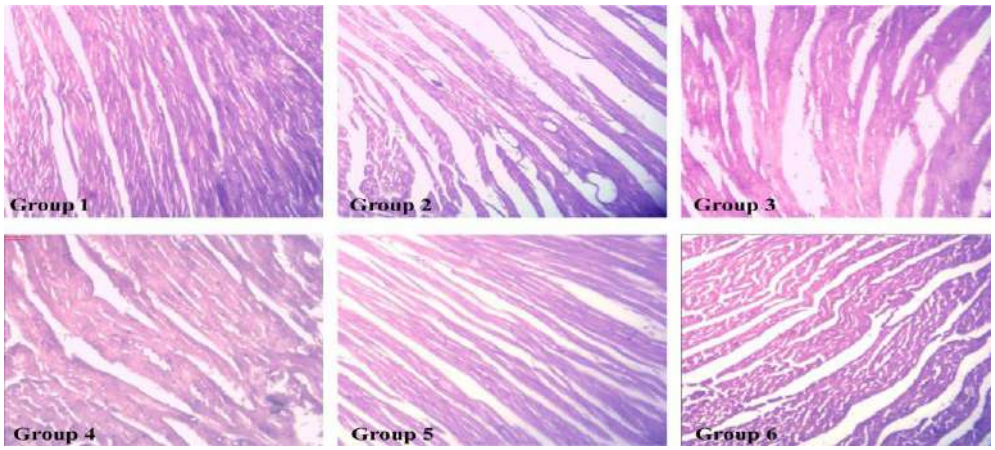


Fig. 1 Photomicrograph showing Histology of cardiac muscle stained with hematoxylin and Eosin. Magnification: 10X. Group 1 - control; Group 2 - High fat diet; Group 3 - streptozotocin-induced diabetes; Group 4 - streptozotocin-induced diabetes + *Gymnema sylvestre* 200 mg/kg; Group 5 - streptozotocin-induced diabetes + *Gymnema sylvestre* 400 mg/kg; Group 6- streptozotocin-induced diabetes + Metformin.

RESULTS

The present study showed a significant increase (P<0.001) of pre-prandial blood glucose level in streptozotocin induced diabetic group (Group 3) and marginally increased in high fat diet group (Group 2). Both dosages of Gymnema sylvestre ethanolic extract treatment (Group 4 and Group 5) were restoring blood glucose level in diabetic induced animals as standard diabetic drug metformin group (Group 6). However the high dose of Gymnema treatment showed remarkable reduction of glucose level (P<0.001) compared to the lower dose of Gymnema [Graph1]. The body weight of the group2 animals was consistently increased (P<0.05) after high fat diet. Whereas in group 3 streptozotocin-induced diabetic animals exhibited abrupt reduction in body weight (P<0.001) compared with control group. Conversely with both the lower and higher dosages of Gymnema sylvestre, (Group 4 and Group 5) the body weight of the animals is conserved (P<0.001). Similar outcomes were observed in Metformin treated group (Group 6)as in Gymnema sylvestre treatments [Graph 2]. The panel of serum lipid profile such as HDL, LDL, VLDL, TGL and Total cholesterol demonstrated a marked elevation in group 2 following high fat diet than the streptozotocin-induced diabetes (Group 3). Although HDL level was significantly reduced in diabetic induced animal when compared with control animals. In both lower and higher dosage of Gymnema treatment showed noticeably increased HDL level in Group4 and Group 5. Despite the recovery of other lipid profile parameters such as LDL, VLDL, TGL, and total cholesterol levels was observed in the Gymnema-treated groups, they did not show statistically significance. Nonetheless long-term Gymnema treatment might produce statistically meaningful results [Graph 2]. The histological investigation of the cardiac muscles [Fig.1] revealed that severe pathological changes in streptozotocin induce diabetic animals. Disarrangement of cardiac muscles fiber, alteration of the shape and size of the nucleus were observed in diabetic animals. These degenerative changes were remarkably reduced in higher dose of *Gymnema sylvestre* treatment that displays normal pattern of myofibril and nucleus arrangement than the lower dose of *Gymnema* and metformin treated groups. However lower dose of *Gymnema* and metformin treated groups the pathological changes were improved compare to diabetic induces animals. The high fat diet group showed similar changes as in diabetic induces group, in addition to that deposition of adipose cells occurs.

DISCUSSION

The decrease in blood glucose level following *Gymnema* treatment clearly indicates the hypoglycemic effect of this herbal drug. The previous experiments also stated that high concentration of *Gymnema* leaves extract reduces the glucose level in albino Wistar rat[16]. The present investigation, the high fat diet group shows increasing body weight and lipid profile panel (HDL, LDL, VLDL, TGL and Total cholesterol). Conversely, streptozotocin-induced diabetic animals' exhibit reduced body weight, increased lipid profiles panel. Interestingly, the *Gymnema* administration normalized these abnormalities. The ameliorating effect of *Gymnema sylvestre* could be due to the presence of active constituents Gymnemic acids and saponin components. Supporting to our statement, Ramesh et al., (2014) described anti-obesity and antidiabetic properties of the Gymnemic acid and it was suggested that *Gymnema* inhibit of triglycerides accumulation in the muscle and liver, along with reduction fatty acid accumulation in the blood circulation eventually decreases body weight. An earlier study also indicated that Gymnema treatment reduced body weight body mass index, and increased VLDL levels in diabetic subjects without affecting insulin secretion or sensitivity[17]. Similar results were observed in patients with impaired Glucose tolerance following Gymnema treatment[18]. Abnormalities of lipid profile levels in diabetic condition (Diabetic dyslipidemia) could be due to reduced turnover of these plasma lipids resulting accumulation in blood circulation. These Diabetic dyslipidemia might be either caused by adipose tissue dysfunction[19] and/or peripheral effect of insulin on adipose tissue[20]. The adipocytes secrete insulin-sensitizing adipokines such as adiponectin and leptin[21]. Adiponectin improves insulin sensitivity and control dyslipidemia through activating AMPK and also increasing fatty acid (FA) oxidation [22, 23]. Leptin is a crucial regulator of energy homeostasis and it is widely recognized that the lower level of leptin increases lipolysis [24, 25]. *Gymnema sylvestre* could ameliorate metabolic imbalance by modulating leptin and adiponectin levels in white adipose tissue[19].The higher levels of total cholesterol, LDL, and triglycerides and lower levels of HDL often associated with an atherogenic pattern of risk factors in pre-diabetic condition[26]. Moreover lipid abnormalities (low HDL, small dense LDL, and elevated triglycerides) increased risk of Coronary Heart disease in Type 2 Diabetes[27]. These investigations are consistent with the current study, which found that streptozotocin-induced diabetic rats had increased lipid profiles and severe histopathological changes in cardiac muscle. However these degenerative changes were remarkably normalized in higher dose of *Gymnema sylvestre* treatment than the lower dose of *Gymnema* and metformin treated groups. On the basis of the results, it is proposed that the higher dosage of ethanolic extract of *Gymnema sylvestre* regularize the lipid abnormalities and also reduce pathological changes of cardiac muscles consequently restore normal histology. The ameliorating effect of *Gymnema sylvestre* could be due to the presence of active constituents Gymnemic acids.

CONCLUSION

The present study concluded that the high fat diet and low multiple dose of streptozotocin induces type 2 diabetes mellitus and cause degenerative changes in cardiac muscle. Both dosages of *Gymnema sylvestre* restored blood glucose level as standard diabetic drug metformin. Interestingly the high dose ethanolic extract of *Gymnema sylvestre* normalize the lipid abnormalities and also reduce pathological changes of cardiac muscles than the lower dose of *Gymnema sylvestre* and metformin. The bioactive components Gymnemic acid, present in this herbal drug could be responsible for these ameliorating effects. However, prospective studies would help to identify more the therapeutic information of *Gymnema sylvestre on* type 2 diabetes associated dyslipidemia cardiac pathophysiology.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-2

Ultrasonic Irrigation- A Review

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Abstract: Debridement of the root canal system is an essential process for endodontic success. Irrigation is important part of root canal debridement. It is difficult to shape and clean the root canal completely because of the complex nature of root canal anatomy. Biomechanical preparation, pulp space sterilization and three-dimensional obturation are the hallmarks of endodontic success. Complete disinfection of the pulp space will be difficult to achieve with most limited instrumentation techniques. Optimal irrigation is based on the combined usage of two or more irrigating solutions, in a specific sequence. The aim of this article is to review newer irrigation systems in endodontic practice.

Key words: Ultrasonic activation, Piezoelectric generators, Endo Activator, Endo Vac, Negative pressure

INTRODUCTION

The success rate of endodontic procedure or treatment depends on the eradication of microbes, smear layer from the root canal and prevent re-infection. The root canal is cleaned and shaped using hand and rotary instruments with constant irrigation to remove the necrotic tissue and inflamed tissue, microbes or biofilm layer, and other debris from the root canal [1]. The main goal of instrumentation is to remove debris, inflamed or necrotic tissue from the root canal [2]. Sometimes instrumentation may not be enough for cleaning the root canal in such cases irrigants can be used. Irrigants can enhance mechanical debridement by flushing out debris, dissolving the tissue, and disinfecting the root canal. Teeth with complex internal anatomy such as fins or other irregularities that might be missed by instrumentation hence they need chemical debridement for successful root canal treatment [3]. For an effective result of cleaning and shaping of root canal, an irrigant should be able to disinfect and penetrate dentin and its tubules, offer a long-term antibacterial effect that is; it should have substantivity, should remove the smear layer, and be non-antigenic, nontoxic and non-carcinogenic [4]. It also should not have any adverse effects on dentin or the sealing ability of filling materials and it should also be relatively inexpensive, convenient to apply and cause no discoloration of tooth. An ideal irrigant include the ability to dissolve the pulp tissue and inactivate endotoxins that may or may not be present [5]. Various irrigants such as saline, sodium hypoclorite (NaOCl), chlorhexidine digluconate (CHX), ethylenediaminetetraacetic acid (EDTA), hydrogen peroxide (H_2O_2), Maleic acid, hydroxyethylidene Bisphosphonate (HEBP), and natural irrigants are mostly used for root canal disinfection and smear layer removal [6]. MTAD, Electrochemically activated solutions, Photon-activated disinfection, and Herbal irrigants are the newer root canal irrigants available in market [7]. An endodontic irrigant should poses a broad antimicrobial spectrum, high efficacy against microorganisms present in biofilms, ability to dissolve the remnants of necrotic pulp tissue, ability to inactivate the endotoxin, ability to prevent the formation of a smear layer during instrumentation or to dissolve the latter once it has formed, systemically nontoxic when they come in contact with vital tissues, non-caustic to periodontal tissues, and with little potential to cause an anaphylactic reaction [3,5].At present, there is no irrigant that combines all the ideal characteristics, even when they are used with a lower pH, increased temperature or added surfactants to increase their wetting efficacy [8, 9]. In practice, current endodontic treatment uses two irrigants, sodium hypochlorite (NaOCl), alone or in combination with ethylenediaminetetraacetic acid (EDTA) or chlorhexidine.In endodontics, ongoing efforts have been made to develop more effective systems to send and agitate irrigant solutions in the canal system. These can be divided into two categories of manual and mechanical agitation techniques. Machine-assisted endodontic procedures include use of rotary brushes, rotary instrumentation with simultaneous irrigation of the canal, pressure alternation devices, sonic and ultrasonic systems. All of them appear to improve canal cleaning in comparison to conventional syringe and needle irrigation [10]. Saline causes less apical tissue damage than other irrigants but the major disadvantage is very less dissolving property and antibacterial activity [11]. Sodium hypochlorite was used for treating wounds during World War I by a physician named Dakin. It was also called as Dakin's solution [12]. There are three different mechanism of action such as saponification reaction, amino acid neutralization reaction, chloramination reaction [13]. Sodium chlorite acts as lubricant, solvent of pulp tissue, antiseptic, bleach according the concentration. Ethylenediamine tetracetic acid is a chelating agent. It is effective in softening dentin and has distinct antimicrobial properties thus it removes smear layer from root canal [14]. Chlorhexidine gluconate is a biguanide. It poses a broad

spectrum antimicrobial action, substantivity and relative absence of toxicity. Usually 0.2% of chlorhexidine is used as irrigant. It causes cytoplasmic precipitation or coagulation on the cell wall [15].

Ultrasonic Irrigation

Richman in 1957 introduced ultrasonic instrumentation to endodontics for root canal treatment. Martin and Cunningham coined the term endosonic. Among all known irrigants, 5.25% Sodium hypochlorite has maximum efficiency upon ultrasonic activation. In combination there occurs heating of irrigant, removal of dentinal debris, movement into apical delta and lateral canals and greater cleaning effect.There are two types of ultrasonic irrigation. The first type is the simultaneous combination of instrumentation as well as ultrasonic irrigation. The second type is passive ultrasonic irrigation (PUI) which functions without simultaneous instrumentation [16]. The first typeis not followed much in the clinical practice, because of the difficulty of controlling the cut of dentin and subsequently the final shape of the prepared canal. When ultrasonic activated files are used in curved canals, there occurs canal deviations, apical zips and radicular perforations [17]. Hence, therefore not considered as an alternative to conventional manual instrumentation[18]. Numerous successful devices have been developed for agitating irrigant solutions, that provide various irrigant transfer mechanisms, elimination of soft tissue and also, depending on the treatment philosophy, elimination of the smear layer. In comparison to sonic irrigation, ultrasonic irrigation have been proved to be more powerful and able to eliminate more debris, and so it is claimed that passive ultrasonic irrigation is significantly more efficient than sonic activation [19]. However, both techniques may clean the canal system to a similar degree when sonic irrigation is applied for a longer time [20]. The capacity of irrigating solutions with good wetting ability to dissolve tissue can be improved by ultrasound if the pulp tissue debris and/or the smear layer are thoroughly moistened by the solution and it is subjected to ultrasonic agitation [7].

Ultrasonic Irrigation Devices:-

Many ultrasonic irrigation devices are available in market with development and extraordinary functioning capacities. They are designed and modified such that the function required to be done is established effectively.

Ultrasonic Activation:-

(Cavi Endo Dentsply International/York/PA/USA) is an ultrasonic system which has been designed first for both prophylaxis and endodontic therapy. It is a magnetostrictive ultrasound unit. The system has a switch, prophy (or) endo mode selection switch, power control dial and water supply control dial along with LED indicators, Air pressure valve window. The Cavi-Endo instrument was reported to be successful in the removal of a broken bur tip and amalgam particles from the intracanal space.

Ultrasonic Activation (Osadaenac ENAC/USA) System:-

It is an ultrasonic endodontic unit designed based on the Quartz Piezoelectric vibrator system. It gets automatically tuned to provide stable 30KHz ultrasonic oscillation. This ultrasound system has a handpiece hose assembly along with holder, a foot switch and also water hose with filter and connector. The functions of this system are simultaneous root canal enlargement with U files and swirling irrigation for debridement, root canal obturation without water, restoration removal, flush cleaning of periodontal pockets and pits and fissures, root-end preparations using angled diamond coated files.

Continuous Ultrasonic Irrigation:-

It is a system designed to deliver continuous Piezo Flow Tulsa (OK/USA) irrigation. It provides excellent cleaning power by facilitating the introduction of irrigants into root canal structure, dentinal tubules and isthmuses. It can disrupt biofilms. It improves the action of sodium hypochlorite even if applied for 1min.The nature of the vibration pattern of the activated file and the effectiveness of ultrasonic debridement is limited by the bedew the file against the root canal wall [21].

Mini Endo Piezoultrasonic Unit:-

It is an exclusively designed ultrasonic cleaning unit for endodontic applications. It is operated and controlled by microprocessors that are designed to deliver the exact amount of power and amplitude at the tip of the instrument to successfully complete the endodontic procedures.

Passive Ultrasonic Irrigation:-

PUI (IrriSafeSatelec (R&D), France) is an uniquely designed system that helps to remove the smear-layer and to kill the microorganisms, even in inaccessible areas or in curved canals. The advantage of this system is that it can be used safely without any risk of damaging the apical structure. Driven by the Newton range of piezoelectric generators, it generates micro-cavitation and microcurrents that spread through the canal system. IrriSafe is small, parallel-shaped and non-cutting (blunt- ended)and can therefore be used in the complete root canal. The

instrument with thinnest diameter is recommended for the majority of the clinical cases (IRR 20), the largest instrument can be used for the treatment of juvenile canals (IRR 25). The instrument should be allowed to vibrate freely inside the lumen of the root canal. IrriSafe is available in two lengths, from IRR20/21 or IRR20/25 and, IRR25/21 or IRR25/25. IrriSafe system is inserted inside the canal 2 mm short of the determined working-length and it can be pre-shaped, if necessary. 20 ml of the irrigant solution is injected into the root canal with a syringe. IrriSafe is activated for 10 seconds, at the recommended color coded power level the instrument is moved with a pull-stroke and backwards; it also drives the debris and the smear layer back to the surface [15].

Endoactivator System:-

Endo Activator(Dentsply Tulsa Dental Specialties) vigorously energize intracanal irrigants using sonic energy. It has strong, flexible medical grade uncoated and non-cutting polymer tips for Single patient use. It creates fluid hydrodynamics, improves debridement and the disruption of the smear layer and biofilm. The handpiece or driver has 3 speed sonic motor that provides low, medium, high speed accordingly [22].

Endovacsystem

EndoVacis considered as an apical negative pressure irrigation system which is composed of three basic components such as a Master Delivery Tip (MDT), Macrocannula, and Microcannula. The MDT component of the system delivers irrigant solution to the pulp chamber and evacuates the irrigant. Both the macrocannula and microcannula components are connected by tubing to a syringe of irrigant and also to the high speed suction of a dental unit. The macrocannula component of the system is made of flexible polypropylene with an open end of 0.55 mm in diameter, an internal diameter of 0.35 mm, and a 0.02 taper. These are used to suction irrigants up to the middle segment of the canal. Lastly, the microcannula component of the system is made of stainless steel and has 12 microscopic holes disposed in four rows of three holes, laterally positioned at the apical 1 mm of the cannula. Each hole of the component is 0.1 mm in diameter, the first one in the row is located 0.37 mm from the tip of the microcannula, and the distance between holes is 0.2 mm. The microcannula component also has a closed end with an external diameter of 0.32 mm that can be used in canals to enlarge the size to 35 or larger, and should be taken upto the determined working length (WL) to aspirate irrigants and debris. During irrigation, the MDT component delivers the irrigant to the pulp chamber and removes off the excess irrigant to prevent the overflow. The cannula in the canal simultaneously exerts negative pressure that pulls the irrigant from its fresh supply in the chamber by the MDT component into the cannula and out through the suction hose. Thus, a constant flow of fresh irrigant into the canal is being delivered by negative pressure till the determined working length. This particular system uses negative pressure in the apical terminus of the root canal to move the irrigation solution through negative pressure gradients [15].

CONCLUSION

Irrigation plays a key role in successful endodontic therapy. Use of sodium hypochlorite helps in achieving maximum chemomechanical debridement. Detailed understanding of the mode of action and mechanism irrigation devices is critical for the use and optimal irrigation.The combination of conventional irrigation together with ultrasonic irrigation facilitates the procedure and improves the elimination of bacteria and the smear layer throughout the canal system thereby contributing to higher success rates for endodontic treatment.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-3

Endodontic Management of Maxillary First Molars with Six Canals - A Report of Two Cases.

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ABSTRACT: The complex root canal anatomy and variations in maxillary molars poses great challenge to dentists performing root canal treatment. Lack of knowledge about root canal complexities and variations could lead to failure of endodontic treatment. It is necessary to understand the morphology of the root canal system before carrying out an endodontic treatment. The use of operating microscope and cone beam computed tomography was crucial in detecting the canals. This report discusses and describes the variation in root canal system of maxillary first molar and its endodontic management.

Key words: Cone Beam computed tomography, Maxillary first molar, Two palatal canals, Operating microscope.

INTRODUCTION

The success of an endodontic treatment mainly depends on knowledge of root canal anatomy and variations which poses a great challenge to clinicians [1]. A major cause for failure of endodontic treatment is lack of knowledge and skill. It is therefore necessary to access, clean and fill all of the canal spaces without leaving any remnant tissue to achieve long term success in root canal treatment [2]. Technological advancements such as operating microscope and computed tomography have been introduced to facilitate detection and assessment of anatomical variations of root canal system. Studies have shown that the usage of magnification increases the chance of detecting additional canals [3]. In general maxillary first molars are regarded as teeth with three roots and four canals mostly. Neelakantan et al found that the prevalence of MB2 canal to be 44.1% in maxillary first molars [4]. The presence of two distobuccal canals was found to be rare and also was reported in 3.6% of maxillary molar [5]. Christie et al reported that there were variations in palatine roots of maxillary first molar [6]. Baratto Filho et al found the prevalence of two palatal canals to be 0.62% (clinical), 2.05% (ex vivo) and 4.55% (CBCT) [7]. Kottoor et al reported about management of maxillary first molars with seven and eight canals [8,9]. The present case study reports the detection and successful management of maxillary first molars with six canals with the help of operating microscope and cone beam computed tomography (CBCT).

CASE REPORT 1

A 48-year-old male patient presented with the chief complaint of pain in left upper back tooth. The pain was continuous and aggravated on consuming hot and cold food. The patient's medical history was non-contributory. Patient had undergone treatment in a clinic where caries was removed, temporary filling was placed and was referred to hospital for further treatment. Clinical examination revealed pain on percussion of the tooth. Electric pulp testing gave a premature response indicating inflammation of pulp. On radiographic examination, the radiopaque material extending to the pulp was found (Figure- 1A). After clinical and radiographic examination, the left maxillary first molar was diagnosed with irreversible pulpitis with symptomatic apical periodontitis. The tooth was anesthetized using 1ml 2% lidocaine containing 1 : 80,000 epinephrine. The temporary dressing was removed and a conventional endodontic access cavity was prepared under rubber dam isolation. On Clinical evaluation of the internal anatomy 3 principal root canal systems were found: mesiobuccal (MB), distobuccal (DB), each revealing one canal orifice and 2 canal orifices were detected in palatal root.In order to improve access to the palatal canals, conventional triangular access cavity design was modified into a trapezoidal shape. Small hemorrhagic pin point spots were found between palatal and mesiobuccal canals after exploring with a DG 16 endodontic explorer under operating microscope. On evaluation MB2 and MB3 were detected (Figure- 1B). The working length was determined in all identified canals using an apex locator and was confirmed with a periapical radiograph (Figure- 1D). Pulp was extirpated from all canals, sterile cotton was placed and access cavity was then sealed with IRM cement. A CBCT imaging of the tooth was advised for further evaluation of this unusual morphology. After obtaining informed consent from the patient, a multi-slice CBCT scan of the maxillary left side was performed. The CBCT scan images confirmed the presence of six root canals (Figure- 1C). The scans showed three mesiobuccal, a single distobuccal and two palatalcanal systems. The MB canal system showed Gulabivala type (3-1) and Sert and Bayirli type XVIII; DB canal system showed Vertucci type I and palatal canal system showed Vertucci type II where

the mesiopalatal (P1) and distopalatal canals (P2) merged in the middle third of the root to follow as a single canal. The cleaning and shaping were performed using NeoEndo and heroshaper nickel-titanium rotary instruments with copious irrigation of 2.5% sodium hypochlorite solution and 17% EDTA. Mesial canals were enlarged upto 25 size with 4% taper, distal canal upto size 25 with 6% taper and palatal canals were enlarged to size 30 with 6% taper. The master cone radiograph was taken (Figure- 1E). The canals were dried and obturation was performed using cold lateral compaction of gutta-percha (Dentsply Mallifer) and a resin-based sealer (AH Plus, Maillefer, Dentsply, Konstanz, Germany) (Figure- 1F). The tooth was then restored with a posterior glass ionomer cement core. The patient was advised a full-coverage crown and was asymptomatic during the follow-up period.

Case Report 2

A 28-year-old male patient presented with the chief complaint of pain in the left upper back tooth. The pain was continuous and aggravated on mastication. The patient also gave a history of nocturnal pain. The patient's medical history was noncontributory. Based on clinical and radiographic examination (Figure- 2A) a diagnosis of irreversible pulpitis with symptomatic apical periodontitis was made and endodontic treatment was suggested to the patient.The tooth was anaesthetized with 1mlof 2% lidocaine containing 1 : 80,000 epinephrine. Under rubber dam isolation, a conventional endodontic access cavity was prepared. Clinical evaluation of the internal anatomy after exploring with DG 16 revealed 3 principal root canal systems: mesiobuccal (MB), distobuccal (DB), and palatal with two canal orifices each (Figure- 2B).In order to improve access to the palatal canals, conventional triangular access cavity design was modified into a trapezoidal shape. The canals MB1&MB2, DB1&DB2 and P1&P2 were found. These were evaluated and verified by a Surgical Operating Microscope. The access cavity was then sealed with IRM. A CBCT imaging of the tooth was advised for further evaluation and understanding this unusual morphology. After obtaining an informed consent from the patient, a multi-slice CBCT scan of the maxillary left side was performed. The CBCT scan images confirmed the presence of six root canals (Figure- 2C). The scans showed two mesiobuccal, two distobuccal and two palatalcanal systems. All three roots showed Vertucci type II canal configuration where the two canals in each root merged in the middle third to follow as a single canal.Working lengths of each canal were determined using an electronic apex locatorand confirmed with a radiograph (Figure- 2D) at the next visit. The cleaning and shaping were performed using NeoEndo and Heroshaper nickel-titanium rotary instruments with copious irrigation of 2.5% sodium hypochlorite solution and 17% EDTA. Mesial and distal canals were enlarged upto 25 size with 4% taper and palatal canals were enlarged to size 30 with 6% taper. The master cone radiograph was taken (Figure- 2 E). The canals were dried and obturation was performed using cold lateral compaction of gutta-percha (Dentsply Mallifer) and a resin-based sealer (AH Plus, Maillefer, Dentsply, Konstanz, Germany) (Figure- 2F). The tooth was then restored with a posterior Glass Ionomer cement core and a week later a full-coverage crown was cemented.

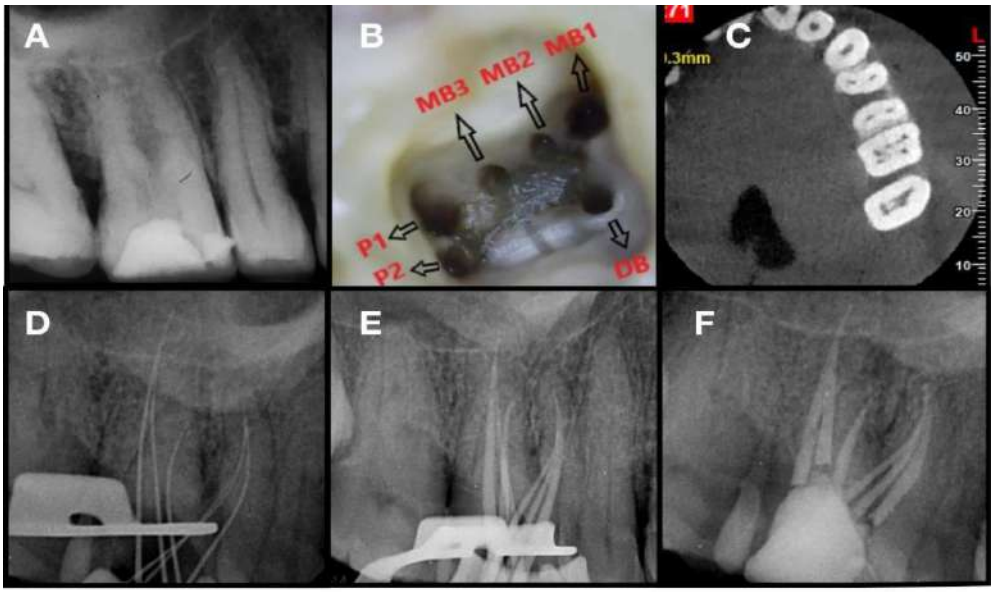

Figure 1 : A- Preoperative radiograph; B- Access opening showing three mesiobuccal (MB1, MB2 and MB3), two palatal (P1 and P2) and one distobuccal (DB) canal orifices; C- CBCT image; D- Working Length radiograph; E- Master cone radiograph; F- Obturation radiograph

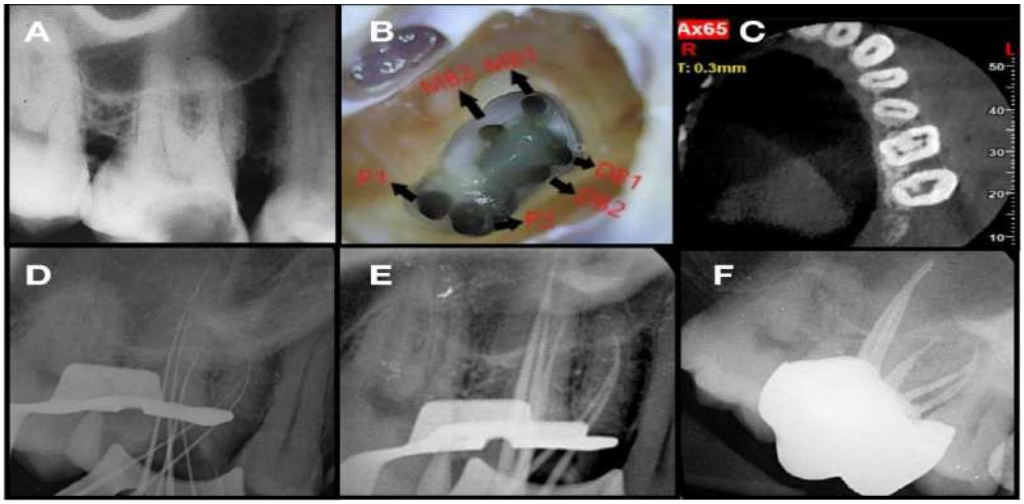

Figure 2: A- Preoperative radiograph; B- Access opening showing two mesiobuccal (MB1 and MB2), two palatal (P1 and P2) and two distobuccal (DB1 and DB2) canal orifices; C- CBCT image ; D- Working Length radiograph; E- Master cone radiograph; F- Obturation radiograph

DISCUSSION

This case report emphasizes the significance adequate access, use of microscope and cone beam computed tomography to improve the likelihood of detecting additional canals. The conservation of tooth structure should always be kept in mind during an endodontic access for successful restoration of the tooth after root canal treatment [10]. Surgical microscope brings minute details into clear view by enhancing lighting and visibility. Studies have proved that magnification and illumination has increased the detection of additional canals [11]. Other diagnostic measures such as multiple preoperative radiographs at different angulations, examination of the pulp floor with a DG16 explorer, use of ultrasonic tips to trough the grooves, staining the chamber floor with 1% methylene blue dye, performing champagne bubble test using sodium hypochlorite and visualizing canal bleeding points are other important aids in locating root canal orifices [12]. Initially, examination of the pulpal floor, following the root developmental fusion lines and exploration of hemorrhagic spots using a DG16 aided in detecting presence of extra orifices and canals in the presented cases.CBCT is a valuable method for initial detection and evaluation of intricate anatomical morphologies of teeth. Hence, a CBCT scanning was performed for a better understanding of the complex root anatomies in the present cases. The newer CBCT scans requires less time due to its ability to acquire whole three dimensional volume of data in a single rotation. The major advantages of CBCT are its intricate details, rapid scan time and effective radiation dose when compared to conventional CT [13].The presence of additional canals in mesiobuccal root of maxillary molars has been described in many studies. JC Kulid, DD Peters [13] and Buhrley LJ et al [14] have concluded the occurrence of second mesiobuccal canal can be between 56.8% and 96.1%. According to Verma P et al [15] and Degerness et al [16], the presence of three mesiobuccal canals can vary between 1.1 and 10%. In case 1, we found three mesiobuccal canals which had Sert and Bayirli type XVIII and CBCT of contra-lateral tooth revealed similar root canal morphology. Additional canals in mesiobuccal root were commonly found in the age group of 20 to 40 years [17]. Surprisingly the age of the patient where three mesiobuccal canals found was 48 years. As the age advances, the root canal becomes simpler due to calcification [18]. Failure in maxillary first molars is majorly due to missed canal in mesiobuccal root [19]. Hence clinicians should be very much aware and pay attention in searching additional canals. The presence of two distobuccal canals was found to be less frequent and has been reported to be between 1.12 and 9.5% which mostly exit as single canal [20,21]. Our second case showed two distobuccal canals which followed vertucci type II configuration. Shahi et al [22] and Zheng et al [23] found the prevalence of two palatal canals in maxillary first molar to be 0.73% and 1.17% respectively. CBCT of both the cases showed six canals, where two palatal canals were found to occur in contra-lateral tooth as well. The incidence of additional canals in bilateral maxillary first molars was higher 58.78% than that of unilateral maxillary first molars which was 52.40% [23]. Evaluation of post-obturation radiograph immediately is mandatory to analyze condensation and apical seal of root canal filling materials. Multiple angulations allow us to appreciate the seal of all gutta percha points in relation to apex of each root.

CONCLUSION

Clinicians should be aware of root canal variations in maxillary first molars and never underestimate it while performing endodontic treatment. The present report highlights the use of microscope and cone beam computed tomography in detecting additional canals. Thorough knowledge, diagnostic aids, location of canals without missing any and operators skill are the keys to achieve success in such complicated endodontic cases.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-4

An Overview Of The Etiology, Clinical Features, Diagnosis And Management Of Cracked And Split Tooth.

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Abstract: The American Association of Endodontists have classified longitudinal tooth fractures into five types; craze line, fractured cusp, cracked tooth, split tooth and vertical root fracture. The purpose of this review is to provide an overview of the etiology, clinical features, diagnosis, and management of cracked and split teeth. Cracked and split teeth are often undiagnosed or misdiagnosed due to their wide variety of clinical presentations. Recognition of the predisposing factors, signs, symptoms, accurate diagnosis and providing the appropriate restoration that protects the tooth from fracture are all important aspects of crack tooth management.

Keywords: Cracked teeth, Split teeth, Etiology, Signs and symptoms, Diagnosis, Management.

INTRODUCTION

The American Association of Endodontists, defined cracked tooth as an incomplete fracture initiated from the crown and extending subgingivally, usually directed mesiodistally[1].Gibbs in 1954, was the first to describe the clinical symptoms of fractured cusp of posterior teeth and named it as "cuspal fracture odontalgia"[2]. In 1957Ritchey et al reported cases of fracture with subsequent pulpitis[3].The term "cracked tooth syndrome" was coined by Cameron in the year 1964[4].Maxwell and Braly (1977) described incomplete tooth fracture as a fracture of the tooth structure that extends into the dentin, but in which the tooth remains grossly intact[5]. Crack may involve one or both marginalridges and proximal surfaces. The crack may be limited to the crown of the tooth or may continue from the crown to the proximal root. Cracked tooth are described as incomplete (greenstick) fractures. If the crack is centered and apical to a fractured cusp, it more likely to cause pulpitis and apical periodontitis as it extends apically [1,4]. If the crack continues to spread, the tooth will splitinto two fragments, resulting in a split tooth[1,6].

ETIOLOGY

The etiological factors for cracked tooth include the following:

- Masticatory forces[1,4,6].
- Dietary habits such as chewing on hard foods[7,8].
- Bruxism[9,10].
- Occlusal prematurity's and trauma from occlusion[9,10].
- Masticatory forces on untreated occult carious lesions[11].
- Differences in thermal expansion and contraction of tooth vs the restoration[10,12].
- Extensive intracoronal restorationsand the use of pin retained amalgam restorations[12,13].
- Endodontically treated teeth extensive forces exerted incondensation of gutta percha during root canal obturation[6,14].
- Improper design/ fitting / seating and cementation of cast post and core and attempts to remove the existing post for replacement[15].
- Excessive torque on the abutment teeth in long span fixed partial dentures[15].

CLINICAL MANIFESTATIONS

In cases of cracked tooth, the patient history may be similar to the fractured cusp. The teeth will manifest the symptoms of the so called the cracked tooth syndrome. This syndrome is characterized by acute pain on biting of grainy, tough foods and sharp, brief pain with cold[16,17,18]. Pain associated with the release of pressure or 'rebound pain' is also a common finding[16,18]. Long-standing split in a vital tooth can involve the pulp, resulting in pulpitis and pulpal necrosis[19,20]. Pulp involvement occurs most often in centrally located cracks. The centrally located cracks follow the lines of the dentinal tubules leading to the pulpal exposure[21].The more peripheral cracks seem to lead to cuspal fracture, with or without pulpal exposure, depending on the amount of secondary dentin. Pulp vitality may be lost due to bacterial penetration through the crack. The pulp first becomes reversible/irreversibly inflamed, later necrotic and affected[20,22]. Symptoms range from slight to very severe spontaneous pain consistent with irreversible pulpitis, pulp necrosis, or apical periodontitis. An acute apical abscess, with or without swelling or a draining sinus tract, may be present if there is periodontal involvement of the necrotic pulp. Split tooth has the same variety of signs and symptoms of the cracked tooth. Split teeth are easier to identify. There is often visual separation of segments. The fractures usually include the pulp. There is also significant damage to the periodontium and can be detected by both patient and dentist[6,19,22].

RADIOGRAPHIC FINDINGS

A) Cracked Tooth

Usually there are no radiographic findings unless the fracture is severe and oriented in the buccolingual direction. Mesiodistally oriented fractures are not visible radiographically[1,16,23]. Radiographs are useful in ruling out caries, broken restoration, root perforations and internal/ external resorptions as the possible cause of the pain source. It also helps to determine the pulp and periapical status. The rate of inter-proximal bone loss (vertical, horizontal, or furcal) can be detected which is directly proportional to the severity of the crack[9,23]. Currently cone beam computed tomography (CBCT) is useful to identify longitudinal fractures in a nondestructive fashion. However, it has been shown to have limited use in identifying incomplete tooth fractures[23,24].

B) Split Tooth

Mesiodistal fracture lines are usually not visible. Often there is marked horizontal loss of interproximal or interradicular bone; this resembles a "u-shaped" furcation lesion[23].

DIAGNOSIS

Early diagnosis of a cracked tooth is critical to alleviate the patient's symptoms while also improving the prognosis.

The following aid in the diagnosis of cracked and split teeth –

- Selective biting on objects such as cotton roll, tooth Slooth or Fracfinder is helpful, particularly when pain is reported on mastication[18,25].
- Transillumination assist in revealing the crack line[19,26].
- Staining with Methylene blue, iodine, or caries detector dye scan reveal cracks although not always predictable[27,28].
- The use of magnifying loupes or a surgical microscope can help to better visualize the presence and extent of the crack[28].
- Periodontal probing may disclose the approximate depth and severity of the fracture[28].
- Wedge test is done to determine if the tooth fragments are separable. If no movements are detected it is a cracked tooth. If the segments separate,it is a split tooth[28].

DIFFERENTIAL DIAGNOSIS–

Craze lines are differentiated from cracked tooth by transillumination. With craze lines, the transilluminated light is not blocked or reflected as in fractured cusp, cracked or split teeth, but the entire tooth is illuminated. To differentiate a cracked tooth from a fractured cusp or a split tooth a wedge test is done. An explorer is wedged into the fracture line. No movement on wedging indicates a cracked tooth. A fractured cusp may break off under light pressure with no further mobility. A split tooth will show mobility on wedging as the mobile fragment extends well below the cemento-enamel junction[1,8,29].Symptoms of cracked tooth can resemble trigeminal neuralgia. Trigeminal neuralgia is characterized by intense, sharp shooting pain that is usually unilateral. Light touch can elicit sharp shooting pain. Once triggered the pain subsides within few minutes until triggered again. In comparison, odontogenic pain can come and go but it does not do so in a predictable or repeatable manner. Odontogenic pain occurs in an area that has no sensory abnormalities (e.g., dyesthesia or paresthesia) [19,30].

PROGNOSIS

A) ***Cracked Tooth*** –

The prognosis of a cracked tooth is reduced and sometimes questionable. The location and extent of the crack determines the prognosis. The patient should be informed about the possible outcomes and the unpredictability of duration of treatment. If left untreated the crack may grow to become a split tooth, requiring tooth extraction or additional treatments[21,31,32].

B) ***Split Tooth*** –

Prognosis is variable. There is a greater chance of successful treatment and restoration when the fracture extends within the middle third of the root. The prognosis is poor if the fracture extends into the apical third[21,31,32].

MANAGEMENT -

A) Cracked Tooth –

The main goal of crack tooth management is to prevent crack from developing further and to improve chewing comfort [21,31,33]. Immediate treatment includes placing an orthodontic band around the tooth[33] or placing a provisional crown [19,31,33]. Final management of a cracked tooth is dependent on the location and extent of crack. Root canal therapy is indicated for cracks that enter the pulp space[34].On removal of the intracoronal restoration and access cavity preparation, the floor as well as the distal and mesial walls should be thoroughly examined for the presence of any cracks. If a crack runs from the mesial wall through the pulp chamber and into the distal wall, the teeth's prognosis is poor, and extraction should be considered. If the crack does not reach the pulp space or is limited to the coronal portions of the mesial and distal walls, the tooth may be saved by pacing a crown over it. The tooth is restored to bind the fractured fragments and also to protect the tooth from further splitting forces. Full crowns are preferred but onlay with bevels may suffice. Root canal treatment followed by a permanent crown provides the advantage of removing long term painful symptoms as well as providing protection against occlusal stresses that can cause a crack tooth to develop into split tooth[21,31,32,35].

B) Split Tooth

When the tooth is split throughout its whole length or diagonally, extraction is the only option. However, if the fracture line is such that the split occurs in large and small portions, and if removing the small portion retains the complete restorable tooth structure, then the tooth may be kept and restored[2,6,35].

CONCLUSION

This article reviewed the etiology, clinical features, diagnosis, and management of cracked and split teeth. Early diagnosis is critical in the management of incomplete fractures to limit the spread of crack, subsequent microleakage and the involvement of pulpal and periodontal tissues.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-5

Management of Vertical Loss by Hemisection - A Report of Two Cases.

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Abstract: Hemisection is the sectioning of a multirooted tooth's crown portion with the loss of periodontal connection in order to preserve the natural tooth structure and get a fixed prosthodontic prosthesis. This is a good therapeutic choice, when caries, resorption, perforation, or periodontal disease is limited to one root and the other root is generally healthy.The present case series discusses the management of periodontally diseased teeth with severe bone loss in which the distal roots were retained to support as an abutment.

Keywords: Root amputation, hemisection, root resection, furcation defect

INTRODUCTION

When one root of a multirooted tooth cannot be preserved, hemisection is suggested so that the other roots have enough periodontal support and the remaining crown structure can be restored[1]. Root amputation, according to Grossman, is a dental example of the proverb "half a loaf is better than none"[2]. Thus tooth resection is a procedure to preserve the remaining tooth structure rather than sacrificing the full tooth[3]. The term tooth resection is the excision and removal of any segment of the tooth or a root. Resection procedures are root amputation, hemisection, Radisection and bisection. Root amputation is the removal of one or more roots while other roots are retained. Hemisection is theremoval of root with its associated crown portion of mandibular molars. Radisection is the removal of roots of maxillary molars. Bisection or bicuspidization is termed as mesial and distal root separation in mandibular molar and those segments are retained individually [3,4].As always, case selection is a crucial thing about success. Proper diagnosis, treatment planning, case presentation, and good restorative procedures are all equally important to the procedure itself [5]. Prognosis is determined by the bone support, occlusal relations, crown–root ratio and restoration [6]. Here, we present two case reports in which periodontally compromised mandibular first and second molars are retained by hemisection.

***Case* I:**

A 45 years old male patient reported to the department of Conservative Dentistry and Endodontics, Sree Balaji Dental College and Hospital, Chennai, with the chief complaint of pain and mobility in his lower left back tooth region. Clinical examination revealed grade I mobility and was sensitive to percussion. On probing, deep periodontal pocket around the mesial root of the tooth was evident. On radiographic examination, it was noted that mesial root had severe vertical bone loss involving the furcation area. The bone support of the distal root was completely intact (Fig 1A). Hence, the treatment plan was to resect the mesial root after the completion of endodontic treatment. The working length was determined (Fig 1B) and the canals were biomechanically prepared using the step-down technique. Root canal treatment was done with obturation of gutta-percha points with lateral condensation method in the distal root and the chamber was filled with composite to maintain a good seal (Fig 1C). Amputation of mesial half (crown and root) was done with the vertical cut method (Fig 1D). Using long shank tapered fissure carbide bur, the crown was cut at the bifurcation area. To confirm separation, a tiny probe was put through the incision. The mesial root was extracted and the socket was irrigated adequately with sterile saline to remove bony chips and composite debris (Fig 1E). The extraction site was irrigated, debrided and sutured with 3/0 black silk sutures. Retained distal root was confirmed by the post operative radiograph (Figure 1F). A fixed bridge with retained distal half and mandibular second premolar with sanitary pontic was designed once the tissues healed.

Case II:

A 38 years old female patient reported to the department of Conservative Dentistry and Endodontics, Sree Balaji Dental College and Hospital, Chennai with the chief complaint of food lodgement in her lower left back tooth region since six months. Clinical examination revealed deep carious lesion upto the furcation associated with 37 and had grade I mobility. On probing 9 mm deep periodontal pocket was seen all around the mesial root of the tooth (Fig 2 A). On radiographic examination, radiolucency was seen till the furcation area. There was vertical bone loss surrounding the mesial root. The bone support of the distal root was completely intact (Fig 2B). After the completion of endodontic therapy of the tooth mesial root was was resected by the vertical cut method (Fig 2 C,D,E). Post operative radiograph shows retained distal root (Figure 2F).

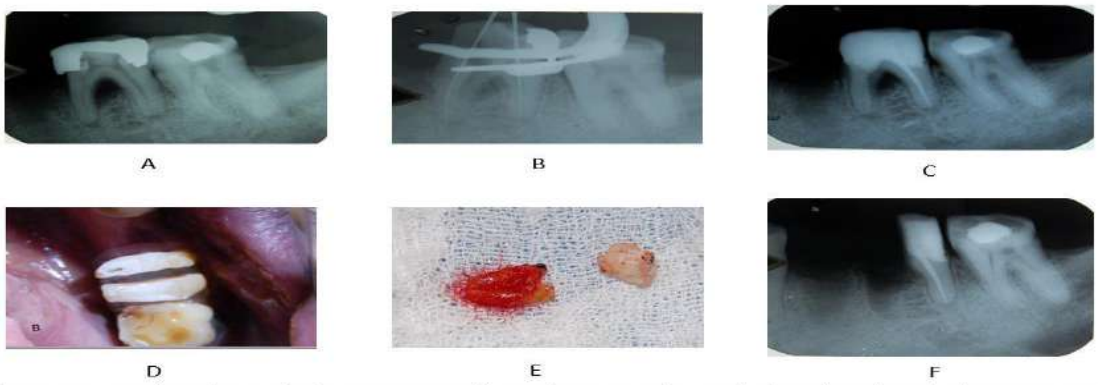

Figure 1- A) Radiograph showing vertical bone loss around mesial B) working length determination C) obturation of only distal root D) Vertical cut towards the bifurcation E) Amputation of mesial half F) Radiograph showing retained distal portion

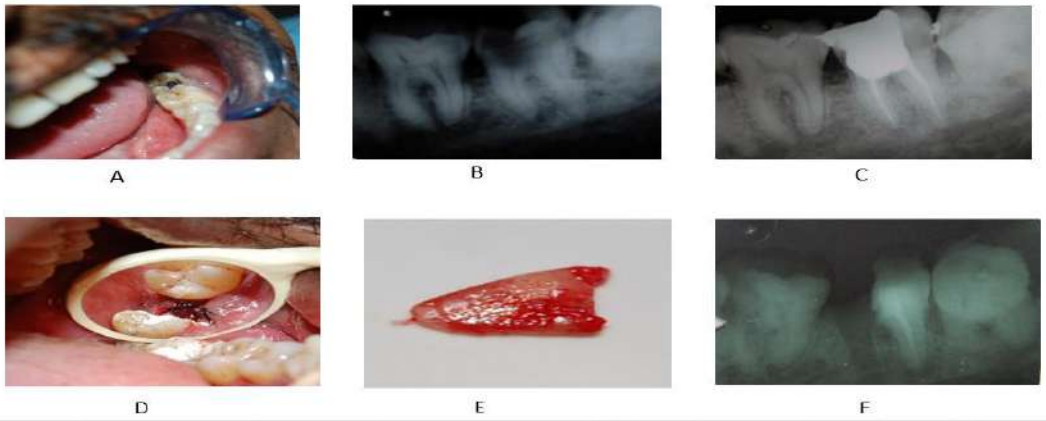

FIGURE 2- A) Pre-operative B) Caries involving furcation vertical & bone loss around mesial root C) obturation of roots D) Vertical cut towards the bifurcation area E) Amputation of mesial half F) Radiograph showing retained distal

DISCUSSION

Root-resection treatment is so technique-dependent and difficult and hence good patient selection is important. For molars with periodontal, endodontic, restorative, or prosthetic issues, root resection is a therapeutic option. The treatment procedures taken to guarantee tooth retention vary in complexity [7]. The predicted treatment of a mandibular molar that has lost all bone support of a root, in other words, that has had a Class II furcation involvement, is frequently a frustrating process for both clinicians and patients. The dentist has traditionally struggled with the treatment, management, and long-term retention of mandibular molar teeth with such invasions. One of the approaches to treat such cases is Hemisection. In the case of problems such as significant vertical bone loss, hemisection is a reasonable alternative to explore before extraction of molars (one root of a multi-rooted tooth), furcation loss, adverse proximity of adjacent tooth roots, preventing adequate hygiene in proximal areas, and severe root exposure due to dehiscence, hemisection is a reasonable alternative before extraction of molars [8]. Endodontic failures, vertical fracture of one root, and non-restorable portion of a multi-rooted tooth are all endodontic/restorative issues that necessitate hemisection [9]. Endodontic treatment is performed on the retained root, and the furcations region is rendered self-cleansable by gently removing the root's lip. Because root fractures cause hemisected teeth to fail, it's critical to repair them properly using an extracoronal restoration [10]. Up to 4 months of follow-up, the patient had an excellent prognosis with correct occlusion, no movement, and a healthy periodontal state. Hemisection is a viable therapeutic option for molar teeth that would otherwise have to be removed owing to severe lesion, according to prior findings [11].

CONCLUSION

Hemisection is an alternative, effective and conservative treatment modality over conventional procedure or extraction of periodontally and endodontic affected teeth. Hemisection should be discussed with patients during consideration of treatment options.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-6

Endodontic Management of Permanent Maxillary Central Incisor with Open Apex- a Case Report

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Abstract: Teeth with open apices, such as those found in immature teeth, or those with apical root resorption, are clinical cases that have a difficult immediate resolution. The use of mineral trioxide aggregate (MTA) in dentistry allowed for the optimization of treatment time in these cases by allowing for the immediate placement of an apical plug and root canal filling. However, if MTA is extruded beyond the apex, some negative effects may occur. This case report describes one clinical case of apical plug placement in teeth with pulp necrosis and open apices. Due to dental trauma, the tooth had an immature apex. A 4 mm thick MTA apical plug was placed in the apical zone of the root, and the canal was immediately obturated with gutta-percha and endodontic sealer. Clinical and radiographic evidence of success was found in follow-up evaluations.

Key Words: Open Apex, Collagen, Endodontics, Mineral Trioxide Aggregate

INTRODUCTION

Open apices complicate root canal treatment because they promote the extravasation of irrigating solution and/or sealer into periradicular tissues, which can impair the apical healing process[1].Immature apexes of early-necrotized teeth or inflammatory apical root resorption are the primary etiological factors for this occurrence[2]. As a result, some techniques, such as chemical or thermal adaptation of the gutta-percha in the radicular apical third and/or apexification with long-term intracanal calcium hydroxide dressing, have been recommended to allow safe root canal filling. However, these methods have numerous technical issues and necessitate multiple treatment clinical sessions[3]. Apical adaptation of gutta-percha with heat or chemical agents such as xylene or chloroform does not provide adequate root canal modelling and leaves gaps between the dentinal wall and gutta-percha. This allows root canal sealer to be extruded beyond the apex and/or apical microbial infiltration[4]. Furthermore, these chemical substances have the potential to be irritating and cytotoxic to periradicular tissue[5]. Although calcium hydroxide intracanal dressing is recommended for treatment of these cases, long-term intracanal use may reduce the resistance of root walls to fracture in the future [3,6,7]. Other issues include the need for multiple treatment sessions, the risk of root canal contamination caused by microbial coronal leakage, and the possibility of an irregular shape of the apical foramen and a porous apical barrier[3,8,9]. To treat teeth with open apices quickly and avoid the potential side effects of long-term intracanal calcium hydroxide use, an apical with freeze-dried bone, tricalcium phosphate, dehydrated dentin matrix, or, Calcium silicate-based cements (CSC), such as mineral trioxide aggregate (MTA) and Biodentine, have recently been proposed[10-14]. MTA is one of the most recommended CSCs for use as an apical barrier (apical plug) due to its excellent biological and physicochemical properties[15,16]. However, it has some drawbacks, including due to their long final setting time and inducing an intense local inflammatory reaction if accidentally pushed into the apical periodontal tissues, they have low resistance to solubilization. To avoid these complications, it has been proposed to use an additional apical matrix with collagen membrane prior to the placement of the apical barrier with MTA[13,14]. Therefore, this report presents open apex teeth with lesion treated with calcium hydroxide and MTA apical barrier prior to root canal filling

Case Report

A 34-year-old, male patient requested dental treatment of the maxillary left central incisor, two years after dental trauma due to car accident, resulted in non-vital discolored tooth. The tooth had initially received coronal access, there was an evidence of pus discharge. The type of open apices was blunderbuss Xray was taken and it reveals presence of periapical lesion with open apices in relation to maxillary left central incisor [Figure 1A] Root canal irrigation was performed with 10 mL of saline, and as a final irrigation protocol, the root canal was flushed with 5 mL of 17% EDTA for 3 min and finished with 10 mL of 3% sodium hypochlorite gel and 10 mL of saline, which was later aspirated and dried with absorbent paper points. Patient sent with open dressing. In sequence of 24 hours, calcium hydroxide intracanal dressing was maintained, for 72 h Two weeks later patient arrived at hospital. Healing of lesion was evident. Working length was taken using El ayoutis technique.[Figure 1B] After this period, a new sequence of irrigation was performed with 5 mL of 17% EDTA, 10 mL of 3% sodium hypochlorite gel and 10 mL of saline. MTA was mixed according to the manufacturer instructions and apical barrier was placed, in approximately 4 mm thickness in the apical third of the root canal with a special device for inserting material. A new radiography was taken to verify the homogeneity of the apical plug [Figure 1C] A #80 gutta-percha point was used for confirmation of the apical barrier [Figure 1D] The root canal was filled with gutta-percha points and zinc oxide-based sealer, by lateral condensation technique. The coronal access was provisionally restored with glass ionomer. The patient was instructed to follow the restorative procedures. [Figure 1E] After 1 month, a new clinical and radiographic control was performed. There were no clinical signs of abnormality in the alveolar mucosa, and the treated tooth showed no sensitivity in vertical and or horizontal percussion. The radiographic assessment indicated local anatomical normality and total regression of the initial radiolucent lesion.

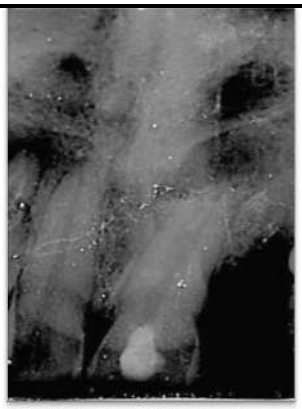

Fig 1A-cleaning and shaping done ,pus drained followed by open dressing

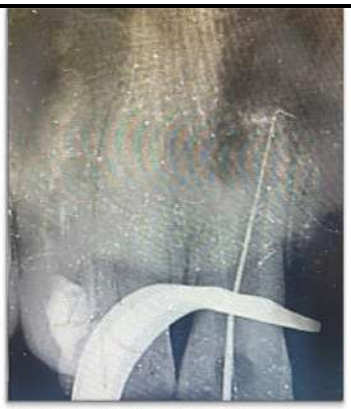

Fig 1B: working length was taken using EL ayoutis technique

Fig 1C-MTA plug placed apically [4mm of working length]

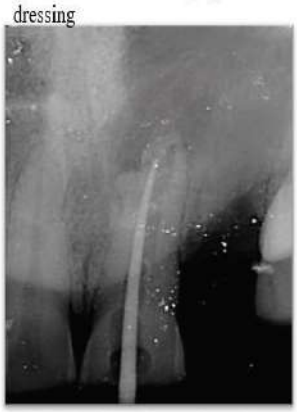

Fig 1D-: A #80 gutta-percha point was used for confirmation of the apical barrier

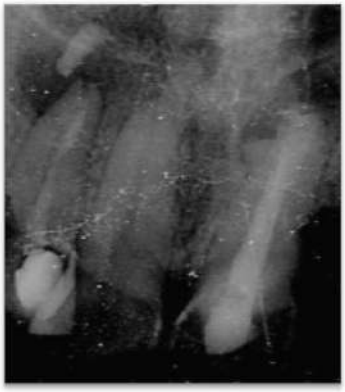

Fig 1E-Evidence of closed apex followed by obturation using roll cone technique

DISCUSSION

In the cases presented, the use of MTA as an apical barrier allowed the treatment of open apex teeth in a single treatment session, reducing the risk of root canal contamination and/or radicular fracture and maximising endodontic treatment time[7,8,18,19]. Despite the fact that the MTA cement's satisfactory physicochemical and biological properties are well-known[2]. Thus, the use of an apical barrier made of a biocompatible material prior to MTA placement is an intriguing treatment strategy for preventing material extrusion beyond the radicular apex[13,14]. Because of its excellent biological properties and resorbability, the collagen membrane is used in periodontal guided tissue regeneration[20]. Nonetheless, among the main disadvantages of collagen membranes are the amount to be used, the material cost, and the difficulty of handling. MTA cement has osteogenic activity and is well tolerated by bone tissue[21,22,23]. MTA cement allows the root canal filling in single session, with safety and non-invasive procedures

CONCLUSION

This case report demonstrated that treatment of open-apex in maxillary central incisor with an apical matrix- MTA apical plug that was condensed to create an artificial barrier at the apex of the tooth (apexification) which resulted in a favorable prognosis.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-7

Antibiotic Resistance Pattern of Staphylococcus Aureus Causing Skin and Soft Tissue Infections

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Abstract: *Staphylococcus aureus*, though a normal commensal of our skin, the most predominant pathogen isolated from most cases of Skin and Soft Tissue Infections (SSTIs) both in the hospital and community settings. Methicillin-Resistant *Staphylococcus aureus* (MRSA) has become a major public health problem in hospitals and communities, accurate information about the changing trends of its resistance patterns is necessary for therapeutic decision making. *S. aureus* (n= 35) isolated from pus samples of patients with skin and soft tissue infections were included in the study. Kirby Bauer disc diffusion method was adopted to determine the antibiotic susceptibility pattern of the *S. aureus* isolates. Resistance to vancomycin was assessed by vancomycin (6 µg/mL) agar screen method. *mecA* mediated oxacillin (methicillin) resistance among the isolates were identified using cefoxitin disc (30 µg) as the surrogate marker (CLSI, 2020). D test was employed to determine inducible clindamycin resistance. Among the 35 Staphylococcal isolates tested, 17(48.9%) were found to be MRSA while, 18(51.4%) were MSSA ($p < 0.05$). None of the *S. aureus* (MRSA & MSSA) isolates exhibited resistance towards vancomycin. All the MRSA isolates were found to be resistant to penicillin. Amongst the MRSA isolates (n=17), 93.33%, 82.35% were susceptible to linezolid, clindamycin respectively. Nevertheless, only 85.71%, 77.7% of the MSSA isolates exhibited susceptibility to linezolid, clindamycin respectively. In our study, 5 isolates exhibited inducible clindamycin resistance. Lesser prevalence of linezolid resistance among MRSA and MSSA suggests that linezolid may be the drug of choice in the treatment of SSTIs caused by staphylococci.

Key words: *Staphylococcus aureus,* Antibiotic resistant, Skin and Soft Tissue Infections, MRSA.

INTRODUCTION:

Skin and soft tissue infections (SSTIs) is a commonly encountered infection worldwide that requires immediate medical attention that imposes a heavy burden in the health care settings. Among the various organisms causing SSTIs, *Staphylococcus aureus* is the most predominant pathogen isolated from most cases of SSTIs both in the hospital and community settings. *S. aureus* though a normal commensal of the external nares is also associated with a range of infections from mild soft tissue infections to severe infections such as septicaemia, pneumonia, infective endocarditis, deep-seated abscess, and toxic-shock syndrome.[1-2] The multi-drug resistance exhibited by the pathogen and its ability to evade the immune system accounts for the difficulty in implementing appropriate antibiotics for treatment.[3] *S. aureus* which was once susceptible to most of the antibiotics has now evolved resistance to most of the antibiotics. This negative transformation is likely to be attained due to its inherent virulence and its potential to habituate to these antibiotics to which it was once susceptible.Over the years, *S. aureus* has acquired resistance to a wide range of antimicrobial classes.[4] Out of the various classes of antibiotics to which the *S. aureus* species has attained resistance, Methicillin (MRSA) and Vancomycin resistance (VRSA and VISA) is the most significant. Methicillin resistance is attained when the methicillin-susceptible *S. aureus* (MSSA) strains acquires *mecA* gene by horizontal gene transfer from staphylococcal cassette chromosome(SCC) which is a mobile genetic element. These SCCs carrying the *mecA* gene (named as SCCmec) are incorporated in the chromosomes of MRSA strains. These SCCmec comprises of mec-gene complex which encodes the mecA gene which is regulated by the regulator genes namely mecR1, mecI and ccr-gene complex which encodes for cassette chromosome recombinase(CCR) that mediates the incorporation and excision of SCCmec into the MSSA strains.[5-6] Currently, Clinical laboratory Standards Institute (CLSI), recommends the use of cefoxitin (30ug) as the surrogate marker for the detection of Methicillin resistance in *Staphylococcus* species.[7] Also, the development of MDRSA (Multiple Drug Resistant *Staphylococcus aureus)* strains may be attributable to the over- use or inappropriate use of antibiotics, deficient investigation facilities and a lack of proper antibiotic policy in clinical practice. A variety of phenotypic variations do exist between MRSA strains isolated from the community (community acquired MRSA, CA-MRSA) and hospital set ups (Hospital acquired MRSA, HA-MRSA). The community acquired MRSA strains exhibit resistant to newer generation penicillins, oxacillin while they exhibit susceptibility to macrolides and lincomycins, erythromycin and clindamycin respectively. Nevertheless, nosocomial MRSA strains exhibit resistance towards multiple antimicrobial classes.[2] Regardless of the boundless initiatives taken by the infection control committees all over the world, there is a substantial increase in the number of MRSA.Various efforts that have been adopted to control the emergence of resistance among *S. aureus* is often hindered by - increased virulence, escalating treatment cost, high budget options available commercially. Thus, timely investigations of the resistance pattern of *S. aureus* species is necessary.[1] The emergence of rapid resistance of *S.aureus* to most of the antibiotics pose a challenge to the treatment options used for the same. Thus, to avoid any treatment failures care must be taken in selection of antibiotics for treating *S.aureus* infections.[5] The present study was designed to determine the antimicrobial

susceptibility pattern of the *Staphylococci* isolated from pus samples and to assess the prevalence of MRSA and inducible clindamycin resistance.

MATERIAL AND METHODS:

A total of 35 *Staphylococcus aureus* isolated from pus samples of patients with skin and soft tissue infections attending a tertiary care Hospital in Chennai were included in the study. Identification of the Staphylococcal species was carried using standard microbiological techniques *viz.,* Gram staining, catalase, oxidase, Coagulase test- (slide & tube method), and further confirmed by plating on Mannitol salt agar (HiMedia laboratories Pvt Ltd, India). Kirby Bauer disc diffusion method was adopted to screen for the susceptibility the *S. aureus* isolates to following antibiotics, ciprofloxacin (5 mcg), chloramphenicol (30 mcg), co-trimoxazole (25 mcg), tetracycline (30 mcg), erythromycin (15 mcg), Teicoplanin (30mcg), Linezolid (30mcg) by as per CLSI guidelines, 2020.[7] Resistance to vancomycin was assessed by vancomycin (6 µg/mL) agar screen method. *mecA* mediated oxacillin (methicillin) resistance among the isolates were identified using cefoxitin disc (30 µg) as the surrogate marker (CLSI, 2020). Isolates with the zone of inhibition ≤ 21mm were classified as MRSA and those which exhibited a zone ≥ 22 was considered as MSSA strains[7]. Inducible clindamycin resistance was determined by Disc approximation test (D test)- clindamycin (2 µg/disc) and erythromycin (15 µg/disc) discs (HiMedia laboratories Pvt Ltd, India) were placed 15 mm apart on Muller Agar plates and were incubated at 37°C for 18 hrs. A D-type flattening of the zone of inhibition of clindamycin zone towards the erythromycin disc was scored as inducible clindamycin resistance, D-test positivity. *S. aureus* ATCC 25923 was included as the standard control.[7]

RESULT:

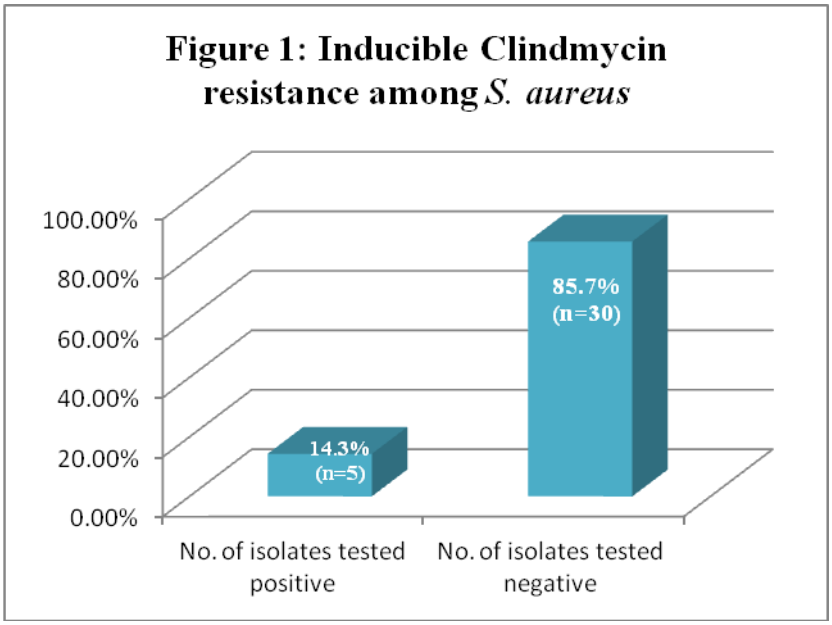
The methicillin resistance in the Staphylococcal species was then determined by performing antibiotic susceptibility testing using cefoxitin as the surrogate marker using Kirby-Bauer disc diffusion method. Among the 35 Staphylococcal isolates tested, 17(48.9%) were found to be methicillin resistant while 18(51.4%) were found to be methicillin susceptible ($p < 0.05$). None of the *S. aureus* (MRSA& MSSA) isolates exhibited resistance towards vancomycin. All the MRSA isolates were found to resistant to penicillin. Amongst the MRSA isolates(n=17), 93.33%,82.35% were susceptible to linezolid, clindamycin respectively. Nevertheless, only 85.71%, 77.7% of the MSSA isolates exhibited susceptibility to linezolid, clindamycin respectively. Of the 17 MRSA isolates tested, the susceptibility to the antimicrobials tested is as follows, tetracycline (61.54%), co-trimoxazole (56.25%), teicoplanin (33.3%) and tigecycline (18.75%) (Table 1). In contrast, higher rate of susceptibility was exhibited by the MSSA isolates (n=18) towards clindamycin (83.3%), tetracycline (85.7%), co-trimoxazole (75.0%), teicoplanin (57.14%) and tigecycline (5.5%) (Table 2). Inducible clindamycin resistance was exhibited by 5(29.4%) isolates, all of which were MRSA stains (Figure 1).

Table 1: Antibiotic susceptibility pattern of the MRSA isolates

MRSA isolates	**Resistance Pattern**		
	Sensitive	**Intermediate**	**Resistant**
Penicillin	-	-	100%
Linezolid	93.33%	-	6.67%
Clindamycin	82.35%	11.77%	5.88%
Co-trimoxazole	56.25%	18.75%	25.00%
Tetracycline	61.54%	15.38%	23.08%
Teicoplanin	33.33%	53.34%	13.33%
Ciprofloxacin	13.33%	6.67%	80.00%
Erythromycin	-	42.10%	57.90%
Tigecycline	18.75%	-	81.25%
Vancomycin	100%	-	-

Table 2: Antibiotic susceptibility pattern of the MSSA isolates.

MSSA isolates	**Antibiotic susceptibility Pattern**		
	Sensitive	**Intermediate**	**Resistant**
Penicillin	11.11%	-	88.9%
Linezolid	85.70%	-	14.30%
Clindamycin	77.78%	-	22.20%
Co-trimoxazole	75.00%	16.67%	8.33%
Tetracycline	85.70%	-	14.30%
Teicoplanin	57.14%	35.72%	7.14%
Ciprofloxacin	25.00%	-	75.00%
Erythromycin	47.06%	11.76%	41.18%
Tigecycline	5.56%	-	94.44%
Vancomycin	100%	-	-



DISCUSSION:

S. aureus is the most predominant pathogen causing pyogenic infections. Traditionally, MRSA has been recognized as a virulent nosocomial pathogen However, community-associated strains of MRSA (CA-MRSA) have emerged over the past several years among healthy young patients without significant health-care contact.[8] The clinical spectrum of CA-MRSA associated SSTIs includes furuncles, carbuncles and abscesses. CA-MRSA, however owing to the presence of unique virulence factors may cause invasive infections including, potentially lethal necrotizing pneumonia. CA-MRSA carry a distinct molecular makeup and lack the MDR genes harbored by HA-MRSA. CDC suggests that MRSA need to be considered in the differential diagnosis of SSTIs, especially those that are purulent (fluctuant or palpable fluid-filled cavity, yellow or white centered, central point or "head," draining pus, or possible to aspirate pus).[9] MRSA is a significant cause of morbidity and mortality. Prompt diagnosis and effective treatment of MRSA skin infections is essential as SSTIs if not treated may lead to more serious infections. Also, follow-up of patients with MRSA SSTIs is recommended by CDC especially if symptoms do not improve within 2 days / worsening of local symptoms/ if the patient develops systemic complications.[9] In our study, 48.6% of the *S. aureus* isolates were found to be MRSA while 51.4% were MSSA. This is line with the report various Indian reports.[10-13] MRSA exhibits resistance to all the currently available beta-lactam agents, penicillins and cephalosporins. Also, fluoroquinolones (e.g., ciprofloxacin, levofloxacin) and macrolides (erythromycin, clarithromycin, azithromycin) are not recommended for therapeutic management of MRSA SSTIs as resistance to these antibiotics is common or may develop rapidly. Nevertheless, clindamycin has been approved by the FDA to treat serious *S. aureus* infections. The centre for Disease Control (CDC) emphasizes that for the erythromycin-resistant isolates, D-zone test need to be performed to identify inducible clindamycin resistance. In our study, 14.3% of the *S. aureus* isolates exhibited inducible clindamycin resistance. This in line with an Iranian report.[14] Nevertheless, an Indian report by Venkata et al, has documented a very high (75.27%) prevalence of MRSA in 2012.[15] A seven year analysis (2009-2015) by Jakribettu *et al* had revealed a steady increase in resistance rate of *S. aureus* to cefoxitin, erythromycin, amikacin, levofloxacin, ciprofloxacin (62.17%) and clindamycin (17.8%).[1] In the present study we report a slightly higher incidence of cefoxitin, ciprofloxacin and clindamycin resistance respectively (48.6%, 80% and 20%). A recent report by Singh et al., which documented a higher resistance of 82. 3% in Tamil Nadu, in the contrary, we report only 20% of the *S. aureus* isolates to be resistant to clindamycin.[16] Linezolid has been approved by the FDA for the treatment of complicated skin infections, including those caused by MRSA (CDC). In our study, 93.3% of the MRSA isolates were susceptible to linezolid. However, administration of linezolid needs to be done with caution. Consultation with an infectious disease specialist is ideal as prolonged therapy linezolid may be associated with myelosuppression, neuropathy and lactic acidosis. But more clinical studies need to be done to evaluate clinical outcome in the patients after treatment with these antibiotics.

ETHICAL CLEARANCE:

This study protocol was reviewed and approved by the institutional ethical committee, Rajas Dental College &Hospital, Kavalkinaru, Tirunelveli district, South India. (EC No: RDCH/EC/09/2018)

CONCLUSION:

In our study a higher incidence (48.6%) of MRSA is documented among SSTIs. Also, we report a slightly higher incidence of cefoxitin (48.6%), ciprofloxacin (80%) and clindamycin (20%) resistance. Higher linezolid susceptibility rate (93.3%) among *S. aureus* isolates in our study, suggests linezolid to the drug of choice in the treatment of skin and soft tissue infections caused by MRSA.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-8

Compound Odontoma with Multiple Denticles in the Anterior Mandible – a Rare Case

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Abstract: Odontomas, the most common odontogenic tumors that are considered as hamartomas rather than true neoplasms. Odontomas can be compound or complex odontoma or rather a rare combination of both compound and complex type. Etiology is unknown but can be due to local trauma or infection. We present a case of compound odontoma with multiple denticles in a 6-year-old girl. Initial local examination revealed the presence of a well-defined palpable swelling in relation to the right side of mandible. Intraoral hard tissue examination clinically revealed missing 81,82 and 41. A well-defined swelling of approximately 2 x 2 cm from the mesial aspect of 31 to mesial aspect of 83 was observed. The lesion was surgically excised by Neumann approach. Radiographic investigation & histopathological examination of the excised lesion confirmed the diagnosis as a compound odontoma with multiple denticles. Local surgical excision is the right treatment option and recurrence is rare.

Key Words: Odontomas, Neumann approach, multiple denticles, hamartomatous malformation.

INTRODUCTION:

The term odontoma refers to any tumor of odontogenic origin. In the present day scenario most of the authors accept that odontoma represents hamartomatous malformation. In the year 1867, Paul Broca coined the term "Odontoma". He defined it as 'tumors formed by the overgrowth of transitory or complete dental tissues'.[1] Etiology is unknown but can be due to local trauma or infection. Hitchin suggested that odontomas are inherited or due to a mutant gene or interference, possibly postnatal by the genetic control of tooth development.[2] But Levy has reported experimental production of odontoma by traumatic injury in rats.[1] In earlier developmental stages varying amount of proliferating odontogenic epithelium and mesenchyme are present. Odontomas consist of both odontogenic hard & soft tissue. Odontomas are further divided into compound & complex odontoma.[4] Compound odontoma the structure of enamel & dentin is laid down in a manner it resembles an anatomic tooth. In complex odontoma the calcified structure is irregularly arranged. Compound odontoma is the most common type when compared to complex odontoma. On the other hand a rare type is found combination of both compound & complex type.

Case Report:

A 6 year old female patient reported to the department of Oral Pathology, Rajas Dental College & Hospital with a chief complaint of swelling in the lower front tooth region since 8 months before which the patient was apparently normal. There was a gradual increment in the size of the swelling since last 8 months. No evidence of pus, blood or discharge from the site was noted. On local examination, a well-defined palpable swelling was present in relation to the right side of mandible with no history of pain. On intra oral hard tissue examination clinically revealed missing 81,82 and 41. A well-defined swelling was observed in the right buccal surface of alveolar region in relation to 82, 83 region, size approximately 2 x 2 cm from the mesial aspect of 31 to mesial aspect of 83. The mucosa over the swelling was normal & no visible secondary changes were noted (Figure 1). On palpation, the swelling was hard in consistency, non-tender, borders were ill defined with smooth edges. The orthopantomagram revealed a well-defined mixed radiolucent & radiopacity measuring about 2x2 cm with a thin radiolucent rim (Figure 2). Based on the history given by the patient/parent and the oral examination, a provisional diagnosis of odontoma was made. Differential diagnosis included ameloblastoma, adenomatoid odontogenic tumor, dentigerous cyst. Based on the radiographic appearance the diagnosis was made as compound odontoma. Surgical excision of the tumor was performed under local anesthesia with Neumann approach (Figure 3). The gross specimen consisted of irregular masses of calcified structure with multiple teeth like tissues (Figure 4).

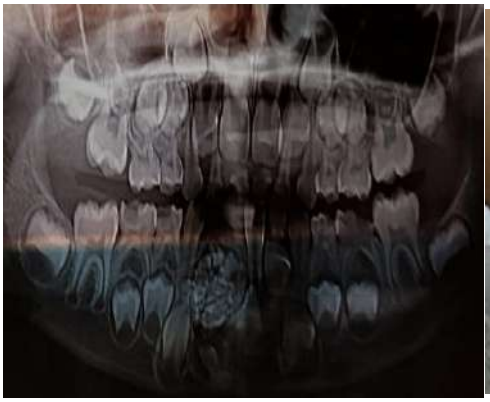

Figure 1: Odontoma- preoperative view

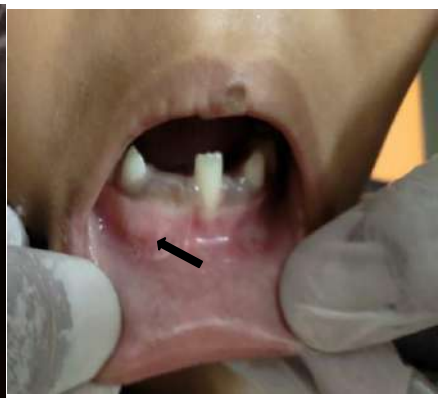

Figure 2: Panoramic radiograph

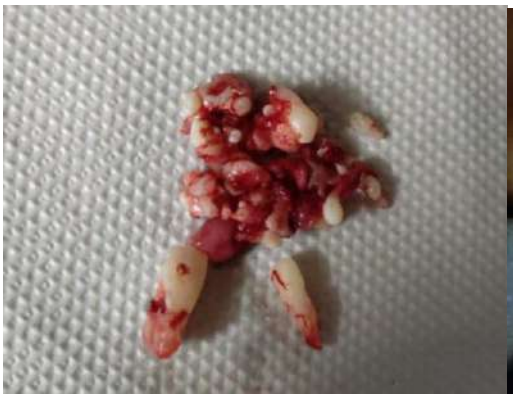

Figure 3: Surgical excision of odontoma

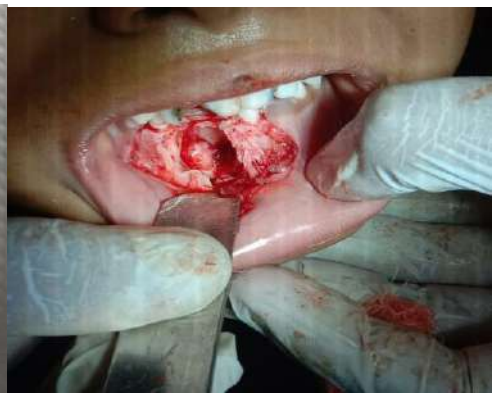

Figure 4: Excised lesion- irregular masses of calcified structure with multiple teeth like tissues

On further histopathological examination of H&E stained section shows thin odontogenic epithelial lining with connective tissue stroma. The connective tissue consists of loose connective tissue stroma arranged in sheets of spindle shaped fibroblast scattered throughout the section. Numerous odontogenic epithelial strands are found in the periphery. Small islands of eosinophilic staining which represents calcification are evident (Fig 5a & 5b). Decalcified section shows organized tooth like structures i.e matured enamel and dentin with dentinal tubules (Fig 5c). Based on the appearance of the gross specimen & the histopathological examination a diagnosis of compound odontoma was made.

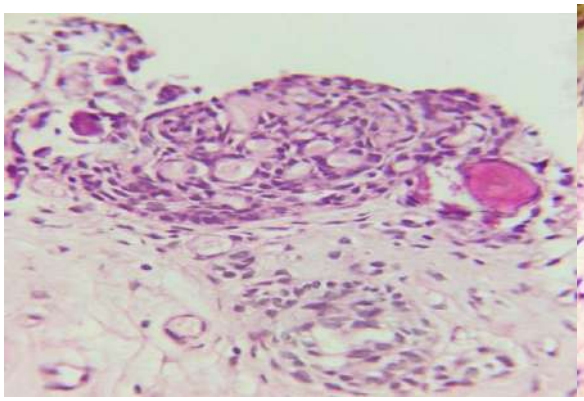

Fig 5a: H & E stained section- showing Odontogenic epithelial strands

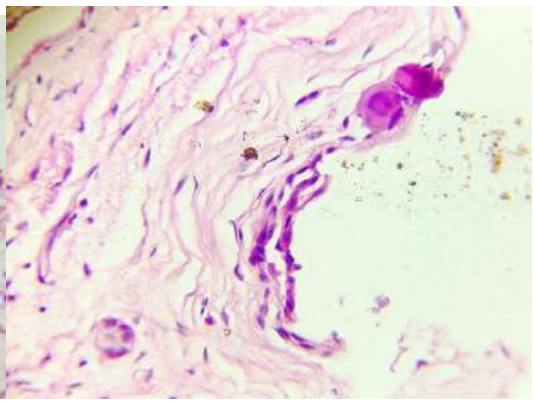

Fig 5b: H & E stained section- showing calcification

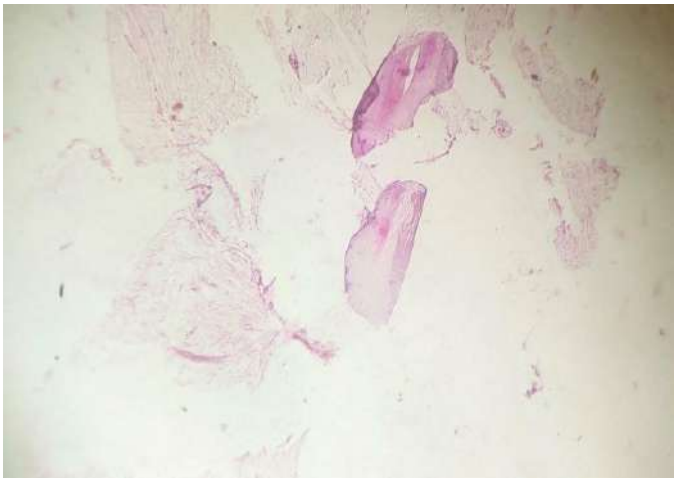

Fig 5c: Decalcified H & E stained section-showing organized tooth like structure

DISCUSSION:

Odontomas, odontogenic tumors are hamartomas rather than true neoplasms. Odontomas occur in the 1st and 2nd decades of life and the mean age is 14 years.[3] They may be detected on investigation of a tooth failing to erupt or as an abnormal swelling. They are usually small and does not exceed the size of tooth. Large cases have been reported about 6cm in size or more in such cases it can lead to jaw expansion.[4] There is a slight male predilection. Of all odontomas 67% occurred in maxilla & 33% occurred in mandible.[1] They usually consist of unerupted tooth, impacted teeth or retained deciduous teeth. Compound odontomas usually do not cause any bony expansion, whereas complex odontomas often cause slight or even marked bony expansion. Pathological changes such as impaction, malpositioning, aplasia, malformation and devitalization of the adjacent teeth can be caused by 70% of the odontomas. Radiographically it appears as tooth like structure of different sizes surrounded by a radiolucent zone.[5] An unerupted tooth is usually associated with the odontoma. Most of the odontoma in the anterior region are associated with compound odontoma and that are in the posterior region are complex odontoma. A developing odontoma can be identified by routine radiographs appear as a circumscribed radiolucent lesion. On histopathological examination, normal anatomic structure like enamel, dentin, cementum & pulp like structure are found. The connective tissue capsule around the odontoma is similar which represents the follicle surrounding a normal tooth. Some ghost like cells is seen in some cases. Morphologic resemblance of single rooted tooth is evident.[6] Fibrovascular connective tissue stroma is evident which consist of odontogenic epithelial islands. Conservative surgical removal is the adequate treatment.[7-10.]

CONCLUSION:

Early diagnosis and surgical excision of the lesion helps to rule out the reason for missing teeth and swelling. Proper radiographic investigation & histopathological examination can rule out odontomas. Rare instance of dentigerous cyst on the walls of odontoma are noted. Recurrence of the lesion is rare when the lesion is completely removed.[7]

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CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-9

Phytochemical Analysis of Methanol Extract of Grape Seed - Vitis Vinifera L.

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Abstract: Grape (*Vitis vinifera L.*) is an important fruit crop grown and consumed worldwide. Grape seed the major solid waste from wine industry are rich in phenolic compounds especially proanthocyanidins that possess varied potential health benefits. The present study was aimed to analyse the photochemical constituents of methanolic extract of grape seeds. Methods: Methanol extraction was performed by cold percolation method. The phytochemicals were qualitatively and quantitatively analysed by appropriate methods viz., Spectrophotometric methods, TLC and HPLC. Results: The qualitative analysis of the phytochemicals revealed the presence of alkaloids, flavonoids, polyphenols and proanthocyanidin. Nevertheless, steroids were below detectable level in qualitative analysis. Proanthocyanidin content was high (367.75 mg/g) in the grape seed extract. This suggests that methanol extract of grape seed is a rich source of proanthocyanidin, a potential therapeutic agent. However, further clinical and animal studies need to be carried out to ascertain the same.

Key words: *Vitis vinifera,* grape seed, proanthocyanidin, phytochemical analysis.

INTRODUCTION

Grapes *(Vitis sps.)* is the widely cultivated fruit crop in the tropical and subtropical areas around the world, mainly for wine production. In India, grapes are widely grown in Delhi, Meerut in Uttar Pradesh, Hissar and Jind in Haryana, Ludhiana and Ferozpur in Punjab, Kolar and Bangalore in Karnataka, Chitoor in Andhra Pradesh, Madurai, Theni, Dindigul and Coimbatore in Tamil Nadu.[1] Grape seeds are the industrial solid waste during grape juice and wine production. Grape seeds are rich in bioactive compounds with promising applications in promoting health and pharmacological benefits.[2] Increasing evidence supports, grape seeds to be rich in proteins, fiber, lipids (omega-6 fatty acid), vitamins, complex carbohydrates and phenolics (70% of total extractable compounds).[2-5] Phenols and phenolic compounds are the amplest secondary metabolites, widely distributed in plant kingdom.[6] The most abundant phenolic compounds in grape seeds include phenolic acids (gallic acid), flavonoids- flavan-3-ol monomers (catechin, Epicatechin and epicatechin-3-O-gallate), and non-flavonoids (stilbenes and procyanidins).[4] Majority of the phenolic compounds (except gallic acid) present in grape seeds, are less soluble in water Also they possess low stability in biological fluids and hence when orally administered there is decreased bioavailability at the target sites.[7-8] From industrial perspective, grape seeds are considered as one of the predominant natural renewable resources of flavanols and polyphenols, because of their low cost and ampleness.[9] Proanthocyanidins are plant derived polyphenols abundantly available in grapes. Approximately 30% of the proanthocyanidin content is present in the seeds, nevertheless the cell walls need to be broken for the complete extraction of the proanthocyanidins.[10-11] Proanthocyanidins are also termed as condensed tannins or catechin tannins, are the biologically active constituent in grape seed extract.[12] It consists of polymers or oligomers of flavan-3-ol units that belong to the wide group of polyphenolic compounds and are byproduct of flavonoid biosynthetic pathway.[13] Based on the intraflavanic linkages, proanthocyanidins are either B-type proanthocyanidins, wherein the monomeric units are typically linked by C-C bonds (mainly C-4→C-8, less frequently C-4→C-6)) or A-type proanthocyanidins characterized by an additional C-O-C bond between C2 → O7 with a wide structural diversity.[14] Grape seed proanthocyanidins belong to type B**.** Proanthocyanidins being condensed tannins are not readily hydrolysed and are decomposable in acidic - alcoholic environment producing insoluble phlobaphenes and anthocyanidins [15-17]. Bioavailability of a compound refers to the proportion of a compound that reaches the systemic circulation following ingestion, digestion and absorption [18]. While, bioaccessibility refers to the sequential reactions including, digestive system transformations, tissue diffusion and biological activity, intestinal and hepatic metabolism, and assimilation into intestinal epithelium cells.[19] Thus, bioavailability is largely dependent on the bio-accessibility.[20] On the other hand, the degree of polymerization largely determines the bioavailability of proanthocyanidins. Proanthocyanidins are broadly classified into oligomeric (2–4 monomers) and polymeric proanthocyanidins (> 5 monomers) based on the number of monomeric flavan-3-ol units contained within it [13].GSPE are reported to possess an array of pharmacological potential including, antioxidant, anticarcinogenic, antibacterial, antiviral, antiproliferative, anti-allergic, anti-inflammatory, vasodilatory, cardioprotective neuroprotective, hypoglycemic hypolipidemic and immunostimulatory properties.[13] Owing to these biological properties, grape seed extracts have been standardized and commercially manufactured in many countries around the globe. Grape seed extracted proanthocyanidins are widely used as a food additive / nutritional supplement in Japan, China, Australia, United States, Korea, as well as in many other

countries.[21-22] Proanthocyanidins of grape seeds are potent antioxidants with higher potency than Vitamin C (20 times) and vitamin E (50 times).[6] Grape seed PCAs exhibit free radical scavenging capacity by effectively modulating the production of intracellular and epithelial nitric oxide, cell apoptotic pathways, lipoxygenase and cyclooxygenase pathways.[23] Proanthocyanidin has the potential to prevent body from sun damage, to promote collagen formation aids in improvement of vision, strengthens blood vessels and connective tissues to improve microcirculation**,** improve immune functions protect cells against drug, chemical and environmental pollutants toxicity.[13, 22, 24] French paradox, the lower incidence of cardiovascular diseases among French people though they consume a high fat diet has been associated with the increased consumption of red wine by those people. Various studies have suggested that the higher concentration of proanthocyanidin in red wine could be the plausible explanation for the French Paradox. Hence, recent studies have largely turned their focus onto complex polyphenols of grape seeds.[25] Selection of the appropriate solvent and the exact solvent:sample ratio is crucial for the higher recovery of phenolic compounds from natural plant products. Though, various organic solvents vis a vis alcohols (methanol, ethanol and alcohol:water mixture), acetone and ethyl acetate have been employed for the extraction processes, methanol is reported to be the ideal solvent for the maximum extraction of phytochemical constituents.[6] Hence, the present study was designed to evaluate the phytochemical constituents of methanolic extract of grape seed and to estimate the concentration of proanthocyanidin in the methanol extract of grape seed.

MATERIALS AND METHODS:

Preparation of Herbal Extracts:

Grape seed powder (*Vitis vinifera*) were procured from InLife Pharma Pvt Ltd., India. Grape seed extract was prepared (2:1 w/v) by cold percolation method using methanol.[26] The herbal extract was evaporated to dryness and the stock solution (100mg/mL) of the extract was prepared using 10% DMSO. The stock solutions were sterilized using Sartorius Minisart syringe filters (0.45 µm).

Phytochemical Analysis of Grape Seed Extract

Thin layer chromatography was employed to qualitatively analyze the presence of alkaloids, flavonoids and polyphenolic compounds, while, High-performance liquid chromatography (HPLC) was performed to estimate the concentration of alkaloids, flavonoids and polyphenolic compounds- proanthocyanidins in the grape seed extract. Spectrophotometric methods were employed for the determination the presence of steroids.

Analysis of Alkaloids:

An isocratic elution system containing acetonitrile and mono basic potassium phosphate was used as a mobile phase. Briefly, 9.93 gm of monobasic potassium phosphate was liquefied in 730 mL of distilled water to which 270 mL of acetonitrile was added mixed thoroughly.[27] The mixture was filtered using a 0.45 µm filter and was degassed. Standard solution was prepared with 0.2 mg of each USP Reference Standard per ml of Methanol: water (1:1 V/V). Equal volumes (10 µL) of the standard solution and the test solution were inoculated into the chromatograph separately. The liquid chromatograph, 4.6-mm × 150-mm column that was packed with L1 was adjusted at a flow rate of 1.8 mL/min. and the detection was performed at the wavelength of 235 nm. The chromatograms were documented and the major peaks areas were measured.

Analysis of Flavonoids:

Quercetin, kaempferol and isorhamnetin was purchased and used as standard in HPLC. Ten grams of the sample was refluxed with the mixture (78 mL) of alcohol, water and Hydrochloric acid (50:20:8) in a hot water bath for 135 minutes followed by the addition of methanol (20 mL) and sonication for 30 minutes.[28] The extract was filtered and the volume was made up to 100mL with Methanol. HPLC analysis was performed with a column 4.6 mm × 25 cm packing contains L1 and a detector with 270 nm at room temperature. Elution was done using the mixture of Methanol, water and Phosphoric acid (100:100:1) and the flow rate was maintained about 1.5 ml/min. The standard solutions and the test solution (20 µL) were separately injected into the chromatograph, the chromatograms were recorded, and the major peaks areas were measured and the amount of total flavonoid in sample was calculated.

Analysis of Total Phenols:

The stock solution was prepared by liquefying 30 mg of dried extract in 25 mL of methanol and water (30:70 V/V)[29] and the mixture was filtered through a sterile membrane (0.45µm). The reference standard (Chlorogenic acid CRS) solution was prepared in methanol (5mg/50mL). The working standard solution was prepared by diluting 5 mL of the reference standard in methanol and water (5:20 V/V). The test sample (30 mg) was diluted in the solvent mixture to obtain 25 mL. HPLC was performed using Shimadzu (Shimadzu, Kyoto, Japan) LC20AT system with UV detection by binary gradient method. Octadecylsilyl silica gel was used as the stationary phase in a column (4.6 mm × 25 cm) maintained at 40°C. Phosphoric acid, water (0.5:99.5 V/V) and phosphoric acid, acetonitrile (0.5:99.5 V/V) were used as mobile phase A and B respectively. The standard solutions and the test solution (25 µL) were separately injected into the system. The flow rate was set to 1.2 mL/min for a total run time of 35 min and the peaks were detected at a wavelength of 330nm. The major peaks areas were measured and recorded. The total phenols present in the sample was calculated using the formula, $A_1 \times m_2 \times p \times 0.125 / A_2 \times m_1$, where

A_1 is the peak area of the test solution, A_2 is the peak area of the reference solution, m_1 is the mass of the test extract (in mg), m_2 is mass of chlorogenic acid CRS (in mg), p is the percentage content of chlorogenic acid in chlorogenic acid CRS. Gradient elution program was proceeded with the following process.

No.	Time (min.)	Mobile Phase A % (V/ V)	Mobile Phase B % (V / V)
1.	0 – 1	92	8
2.	1– 20	92 - 75	8 – 25
3.	20 - 33	75	25
4.	33 - 35	75 - 0	25 – 100

Analysis of Steroids

The stock reference standard (Betamethasone) solution was prepared in aldehyde - free ethanol and finally diluted to obtain a working solution of the steroid (10µg / mL). The test sample solution was prepared in aldehyde free ethanol to obtain a concentration of 1 gm, aldehyde-free ethanol was included as the blank.[30] Briefly 20 mL of the blank, standard (10µg / mL) and test (1 gm) were taken in three separate screw capped test tubes. Two mL of blue tetrazolium solution and 2 mL of tetramethyl ammonium hydroxide solution (10% solution in aldehyde - free ethanol) was added to all the 3 tubes. The tubes were mixed and incubated in the dark at room temperature (25°C - 35°C) for 90 minutes. After incubation, 1 mL of glacial acetic acid was added to all the tubes and mixed thoroughly. The absorbances of the test solution and the standard solution was measured spectrophotometrically with DLAB SP-UV1000 SPECTROPHOTOMETER (CHINA) at a wavelength of 525 nm with reagent blank as reference. The total steroids in 20 mL of the test solution were calculated using the formula, At / As X Cs, Where At was the test solution absorbance; As, was the standard solution absorbance; Cs denotes the concentration of the standard (x mg/20 mL).

ANALYSIS OF PROANTHOCYANIDIN

The stock solution of the extract was prepared by liquefying 1 g of dried extract in 25 mL of the solvent mixture, HCl:CH_3OH (2:98V/V) [31] and diluting it with dilute phosphoric acid (5 ml in 20 mL), filtered and used as working solution. The reference standard solution was prepared by dissolving 10 mg of cyanidin chloride CRS in 25 mL of the solvent mixture, HCl:CH_3OH (2:98V/V) and further diluted with dilute phosphoric acid (2 ml in 100 mL) for the working solution.HPLC analysis was performed by using Shimadzu LC with 370 nm detector. The column C18 (4.6 mm × 25 cm) packed with 5µm Octadecylsilylsilica gel (stationary phase) and maintained at 30° C. The volume (10µL) of the working solution of the extract, reference standard- cyanidin chloride CRS) was injected and flow rate was set at 1 mL/min. The gradient elution was accomplished using solvent A (anhydrous formic acid and water (8.5:91.5 V/V)) and solvent B (anhydrous formic acid, acetonitrile, methanol and water (8.5:22.5:22.5:41.5 V/V)). The chromatograms were recorded, and the major peaks areas were measured. The total proanthocyanidins in the sample was calculated by the formula, $A_1 \times m_2 \times 100 \times p / m_1 \times A_2 \times 1250$, where A_1 is the peak area of test solution, A_2 is the peak area of reference solution, m_1 is the mass of the extract (in grams), m_2 is mass of chlorogenic acid CRS (in grams), p is the percentage of cyanidin chloride CRS. Gradient elution program was accomplished with the following process.

No.	Time (min.)	Mobile Phase A % (V/ V)	Mobile Phase B % (V / V)
1.	0 – 35	93 - 75	7 – 25
2.	35 – 45	75 - 35	25 – 65
3.	45 – 46	35 - 0	65 – 100
4.	46 – 50	0	100

RESULTS:

The phytochemicals such as alkaloids, flavonoids, phenols and polyphenols qualitatively analysed by thin layer chromatography revealed the presence of a high content of polyphenols (++++++) followed by flavonoids (+++++), phenols (++++) and alkaloids (++++). UV spectrophotometric analysis of revealed that steroids were below the detectable level. Quantitative assessment of the phytochemicals, alkaloids and flavonoids by high performance liquid chromatography, indicated that alkaloids were higher in concentration (12.66 mg) than the flavonoids (4.56 mg) (Fig 1, 2).

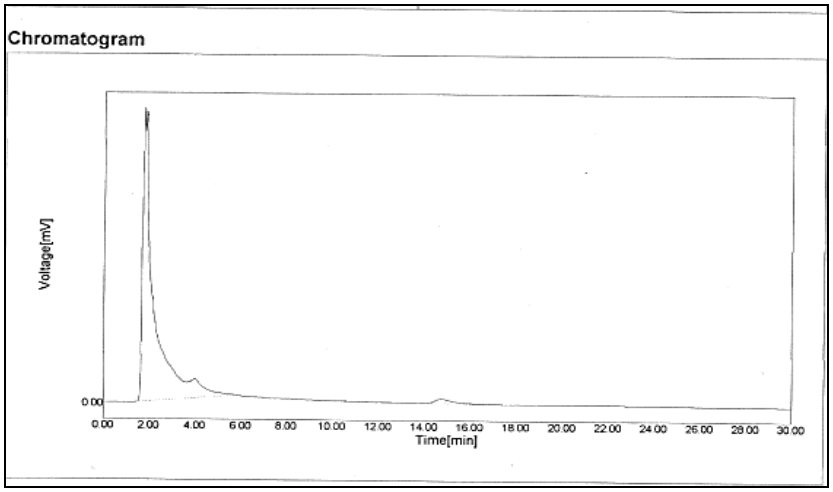

Fig 1: ANALYSIS OF ALKALOIDS - CHROMATOGRAM

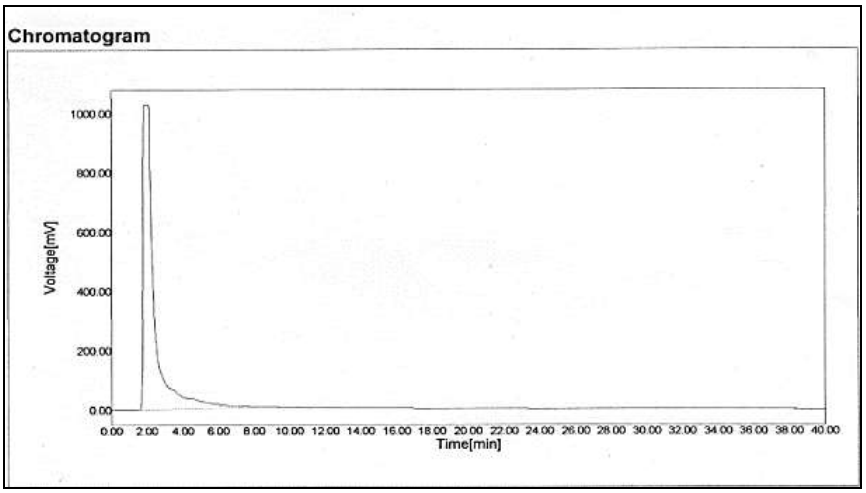

Fig 2: ANALYSIS OF FLAVONOIDS - CHROMATOGRAM

Total Phenols:

The phenols were qualitatively analysed by thin layer chromatography and quantitatively analysed by high performance liquid chromatography. A very high amount of poly phenols was indicated in TLC. The polyphenol content in the methanol extract of grape seed was found to be 22. 55 mg (Fig 3).

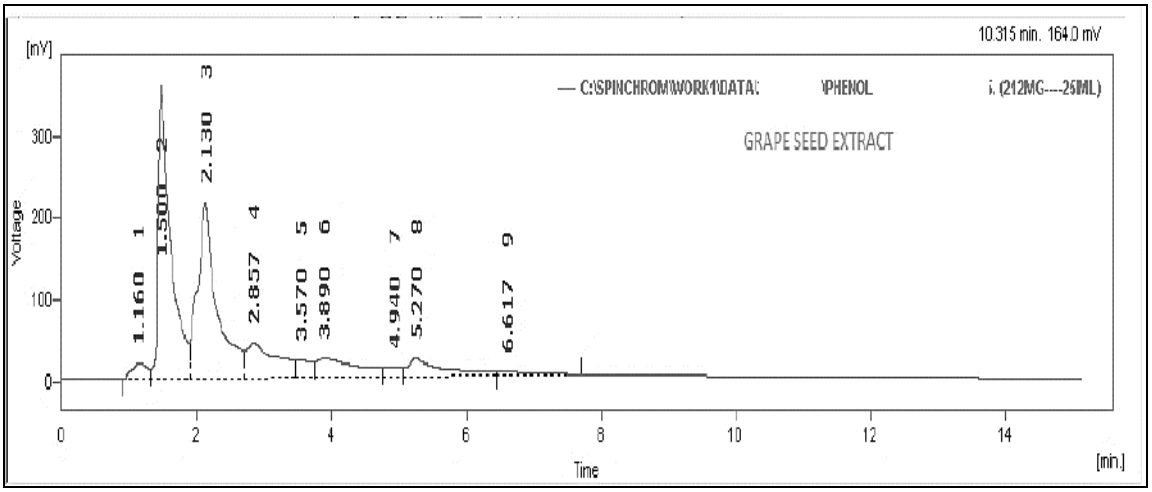

Fig 3: ANALYSIS OF TOTAL PHENOLS - CHROMATOGRAM

PROANTHOCYANIDIN:

The proanthocyanidin was analysed by high performance liquid chromatography. The retention time of the standard peak was 14.7 min/mV which corresponds with the grape seed extract sample peak 15.08 min/mV and the content of proanthocyanidin in grape seed extract was reported as 367.75 mg/g (Fig 4).

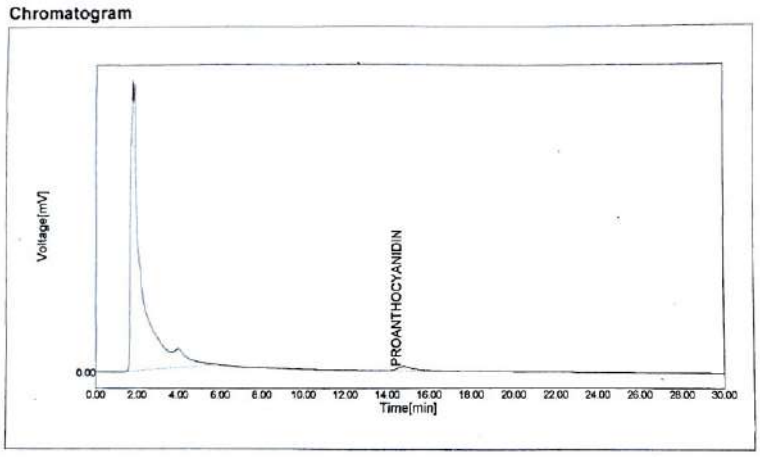

Fig 4: ANALYSIS OF PROANTHOCYANIDIN - CHROMATOGRAM

DISCUSSION

Grape is one of the widely cultivated fruit crops around the world and rich in bioactive components with health promoting and disease managing properties. Grape seeds have 70% of total extractable phenolic compounds, lipids and vitamins. The most commonly found phenolic compounds are phenolic acids, flavonoids and non-flavonoids (tannins and stilbenes). The grape seed has increased amount of total phenolics compounds followed by skin (28-35%) and pulp (≤ 10%).[13] In our study, a high content of polyphenols (22.55 mg) was noted while steroids were less in the methanol extract of grape seed. The phytochemical constituents of the methanol extract of grape seed included, polyphenols, alkaloids and flavonoids. Owing to their sour taste, proanthocyanidins are used in fruit juices and beverages to increase their shelf life. Proanthocyanidins are used as food additives to increase salivary viscosity and microbial stability, to improve heat stability and oxidative stability and foamability.[13] Various studies have documented that grape seed proanthocyandin exhibits a wide range of chemoprotective, biological and pharmacological properties and helps the cells to defend against environmental toxic pollutants, drugs and chemicals which leads to certain forms of cancer.[32] In this study, proanthocyanidin content was found to be higher (367.75 mg/g). Food and Drug Administration (FDA) has approved grape seed extract as generally recognised as safe (GRAS) and commercially being marketed as health supplement on Everything Added to Food in the United States (EAFUS) database.[24] Oral administration of grape seed proanthocyandins (200-300 mg / day) is reported to prevent epigastric pain. Notably it reduces the intensity and recurrence of pain and thereby reduces the usage of analgesics.[13]

CONCLUSION:

Phytochemical analysis of methanol extract of grape seed - *vitis vinifera l.* revealed the presence of a high content of polyphenols followed by flavonoids, phenols and alkaloids. HPLC analysis indicated that alkaloids were higher in concentration (12.66 mg) than the flavonoids (4.56 mg) while, steroids were below the detectable level. Of note, proanthocyanidin content was high (367.75 mg/g) in the grape seed extract. This suggests that methanol extract of grape seed is a rich source of proanthocyanidin, a potential therapeutic agent. However, further clinical and animal studies need to be carried out to ascertain the same.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-10

Effects of Tobacco Cessation: A Detailed Review

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Abstract: In India, tobacco use is incredibly linked to poverty and accounts for the high public health costs of treating tobacco-related diseases. Dental public health programs aid in detecting the tobacco related periodontal diseases, oral cancers, etc., where the majority belongs to the submerged portion of iceberg, which otherwise leads to substantial morbidity and mortality. Moreover, Dentists plays a key role in identifying both clinical and subclinical cases and aid in tobacco use cessation through various modes of health education and counseling. Therefore, the community-based measures are deemed to be the most cost-effective tool for tobacco cessation.

Key words: Oral Cancer, Tobacco, Tobacco Cessation

INTRODUCTION

Tobacco use is one among the five greatest risk factors for mortality, and also the single most preventable cause of death.[1-4] In developing countries like india, the disease burden, health care costs as well as other fiscal losses resulting from premature deaths attributable to tobacco consumption are increasing rapidly. World Health Organization (WHO) estimates in 2004 projected 58.8 million deaths to occur globally, of which 5.4 million are attributed to tobacco use. As of 2002, 70% of the deaths are in developing countries. It is predicted that 1.5–1.9 billion people will be smokers in 2025.[2,3]India is the second largest consumer of tobacco in the world. The prevalence of all types of tobacco use among men has been reported to be high in most parts of the country (generally exceeding 50%).[5] Further, a national level survey on tobacco use in India has reported that 16.2% are current smokers and 20.5% are tobacco chewers. This survey also showed that beedi is the most popular form of tobacco smoking, followed by cigarette smoking; similarly, pan with tobacco is the major chewing form of tobacco.[6]This has attributed to the dramatic increase in tobaccoassociated oral problems like Oral Precancerous Lesions And Conditions such as Leukoplakia, Erythroplakia, Oral Submucus Fibrosis, Periodontal Diseases, Tooth Loss And Cancers Of Oropharyngeal Region.[3,7,8] Studies have shown that India has the highest rate of oral cancer in the world. Annually almost 7% of all cancer deaths in males and 4% in females are due to tobacco-related oral cancers.[8,9] Moreover, it is estimated that 56,000 new cases of tobacco-related oral cancers occur every year, which would lead to more than 100,000 individuals suffering from the disease in the population in any given year. Nearly 95–100% of tobacco users develop periodontal diseases which have a diminishing effect on oral health. As a result, tobacco-related oral manifestations have a negative impact on oral health and quality of life.[1,9,10]

Tobacco-Induced Oral Disease

It is firmly established that tobacco use is a primary cause of many oral diseases and adverse oral conditions . Tobacco is a risk factor for oral cancer, oral cancer recurrence, adult periodontal diseases, and congenital defects such as cleft lip and palate in children whose mother smokes during pregnancy. Tobacco use suppresses the immune system's response to oral infection, retards healing following oral surgical and accidental wounding, promotes periodontal degeneration in diabetics and adversely affects the cardiovascular system. These risks increase when tobacco is used in combination with alcohol or areca nut. Most oral consequences of tobacco use impair quality of life be they as simple as halitosis, as complex as oral birth defects, as common as periodontal disease or as troublesome as complications during healing.[11]

Impact of Smoking Cessation

Guide to Counseling for Tobacco Cessation (Quitting)

A) For those willing to quit The 5 "A" method 1) Ask – about tobacco use at every visit, 2) Advise – non-users to never use tobacco and users to quit, 3) Assess – the patient's readiness to quit and the level of dependence, 4) Assist – with quitting, 5) Arrange – follow-up visits.(Table 1) [3,4,8,10,12-15]

B) For those not willing to quit The 5 "R" method Ask and\or advise the patient about: 1) Relevance of quitting, 2) Risks of continuing tobacco use, 3) Rewards of quitting, 4) Roadblocks to quitting, 5) Repeat these at every visit.(Table 2) [3,4,8,10,12-15]

TABLE 1: THE FIVE "A'S" FOR SMOKING CESSATION

APPROACH	SUGGESTED ACTIONS OR PATIENT DIALOG
	ASK
Tobacco use Include current and former use Include noncigarette products Document in patient chart	Do you ever smoke or use any other type of tobacco, including Smokeless tobacco and cigars? I take the time to ask all of our patients about tobacco use because it is important
	ADVISE
Give clear, strong, nonjudgmental, and personalized advice to quit Connect advice with oral findings	There have been some tissue changes in your mouth and gums since your last visit. Tobacco use is affecting your health The best thing that I can do for your current and future health is to advise you to stop smoking
	ASSESS
How willing is the patient to make a quit attempt? If motivated: Help the patient create a quit plan If not motivated: Enhance the patient's motivation to quit	Would you like to try to quit tobacco in the next month (or year)? If so, we can help
	ASSIST
Help to create a quit plan, involving Set a quit date within 2 weeks Review past quit attempts Avoid other tobacco users T ell family and friends Remove tobacco from home, work, and car Avoid alcohol Recommend or prescribe pharmacotherapy Enhance motivation to quit using the five R's approach	For patients who are ready to quit Would you like to create a quit plan with me today? For patients who are not ready to quit: Provide a brief intervention or a motivational interview using the 5 R's approach
	ARRANGE
For patients not ready to quit Document in chart Follow-up at the next appointment For patients ready to quit Refer to toll-free quit line, tobacco counselor or local community-based tobacco cessation programs Document in chart Coordinate with other providers (e.g., patient's physician) to reinforce the quit plan Schedule a follow-up appointment to review progress and provide additional counseling	For patients not ready to quit If it is okay with you, I will like to check in with you at your next appointment to see where you are in your decision making For patients who are ready to quit If it is okay with you, I will like to schedule a follow-up appointment or phone call to discuss your progress

TABLE 2: THE FIVE R'S APPROACH TO TOBACCO CESSATION	
APPROACH	**SUGGESTED ACTIONS OR PATIENT DIALOG**
	RELEVANCE
Encourage patient to indicate why quitting is personally relevant	Why is quitting tobacco something that matters to you?
	RISKS
Ask the patient to identify potential negative consequence of tobacco use	What do you think are some of the consequences of using tobacco?
	REWARDS
Ask the patient to identify potential benefits of stopping tobacco use	What do you think are the best things that will come from quitting tobacco?
	ROADBLOCKS
Ask the patient to identify barriers or impediments to quitting	What do you think are some of the things preventing you from quitting tobacco? Can you think of any ways to get around these barriers?
	REPETITION
The motivational intervention should be repeated every time an unmotivated patient has an interaction with a dental practitioner Tobacco users who have failed in previous quit attempts should be encouraged to continue trying to quit and be reminded that repeated attempts are often necessary	Quitting is hard, but it can be done. Most people make multiple quit attempts before they are finally successful

Tailoring Messages to the Patient's Stage of Change :

It is well known that quitting is a process rather than an event which not only requires individual efforts but also necessities extreme co-ordination from all the sectors to achieve greater success rates. However, the intervention aimed at tailoring messages to the patient's stage of change can help the tobacco user move forward on the road to permanent abstinence [Table 3].[4,10,12,13,15,16] Thus, adopting such tailoring message into the field of dentistry and public health dentistry, in particular, can be one of the most effective behavioral interventional therapies.

TABLE 3: TAILOR MESSAGES AND GOALS TO THE PATIENT'S STAGE OF CHANGE		
If the patient reports	**Goals**	**Examples of messages**
I'm not ready to quit	Get the patient to think about quitting • Praise prior attempts •Examine reasons for using tobacco	"Quitting tobacco use can be difficult." "What do you like about using tobacco?" "Is there any reason you might think about quitting it in the future?" "It sounds like you're not thinking about quitting right now. If you want to talk about this any time, please let me know."
I'm ready to quit now	Develop treatment plan (using the 5 "A" method) • Set a quit date • Counsel briefly • Refer for intensive counseling if needed • Follow-up	"It's important to set a quit date." "Getting added help, such as intensive counseling, can really increase your chances of successes." "What are your plans if get cravings?" "We need to talk or meet again. I want to see how you're doing."
I quit recently	Help the patient maintain abstinence • Review ways to avoid slips • Identify social supports	"You should be proud of yourself." "Are others supporting your efforts?" "Is there anything we can do to help you stay off tobacco?"
I quit long ago	Congratulate the patient	Keep it up. Never take another puff
I relapsed recently	Reassess the patient's motivation • Praise the attempt to quit •Turn feeling of failure into small success	"You should feel good about trying to quit." "Any time you're ready to try again, we are ready to help you." "What might you do differently next time?"

Nicotine-Replacement Therapies

Success is most likely to be achieved when counseling and pharmacological approaches, such as nicotine-replacement therapies [Table 4], are used in combination.[17,18]

TABLE 4: FIRST LINE PHARMACOTHERAPIES FOR SMOKING CESSATION

PHARMACOTHERAPY	DOSAGE	DURATION
Bupropion sustained release	150 mg every morning for 3 days, then 150 mg twice daily (begin treatment 1-2 weeks precessation)	7-12 weeks maintenance up to 6 months
Nicotine gum	1-24 cigarettes/day-2 mg gum (up to 24 pieces/day) 25+cigs/day-4 mg gum (up to 24 pieces/day)	Up to 12 weeks
Nicotine inhaler	6-16 cartridges/day	Up to 6 months
Nicotine nasal spray	8-40 doses/day	3-6 months
Nicotine patch	22 mg/24 h 14 mg/24 h 7 mg/24 h 15 mg/16 h	4 weeks then 2 weeks then 2 weeks 8 weeks
Nicotine lozenge	2 mg lozenge (if first cigarette is 30 min or more after awaking) 4 mg lozenge (if first cigarette is 30 min or less after awaking) No >20 lozenges/day	Weeks 1-6 1 lozenge every 1-2 h Weeks 7-9 1 lozenge every 2-4 h Weeks 10-12 1 lozenge every 4-8 h

Barriers for Tobacco Cessation

Despite the imperative role of public health dentist in tobacco cessation, there are certain barriers averting their tasks on tobacco cessation. This can be due to the following reasons:

- There is no remarkable internal motivation among the tobacco users due to their deprived socioeconomic conditions, stress, and other allied reasons. This mainly hampers the community participation in tobacco cessation.[22]
- The majority of societal members strongly resist tobacco cessation since they believe smoking is a macho habit.
- Most of the dental professionals do not have sufficient skill, time and desire for participation in tobacco cessation activities.[4,10,19,20,22]

In India where there is a predominant influence of socio-cultural practices on tobacco use, it becomes the most challenging task for the public health dentist to assist in its cessation [21]

- Major difficulty in tobacco cessation is the behavioral aspect of tobacco use. This can be overcome through proper • Further, reinforcement of behavior intervention procedures.

- tobacco is considered to be one of the cash crops for farmers and advising them for an alternative crop is the one of the major confront for all the sectors including the public health dentist.[22]

CONCLUSION

With a growing smoking prevalence, the proportion of tobacco-attributed disease will probably contribute comparably more to total periodontal disease in future years. The American Academy of Periodontology Parameters of Care include tobacco cessation as a part of periodontal therapy. Thus, as a part of community-based program, dentist plays an essential role in the control of tobacco epidemic through participation in various tobacco use cessation programs by identifying cases and providing health education and proper referrals. This can help in reducing the morbidity and mortality caused due to tobacco use.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-11

Effects of Smoking Form of Tobacco on Periodontal Health: A Review

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ABSTRACT: Cigarette smoking is a risk factor for several diseases, and recent evidence strongly suggests an adverse effect on periodontal health. Nevertheless, the nature of the relationship between smoking and periodontal disease is not clear. Smoking causes defects in neutrophil function, impairs inflammatory and immune responses to periodontal pathogens, and exerts both systemic and local effects. Smoking is associated with an increased rate of periodontal disease in terms of alveolar bone loss and attachment loss, as well as pocket formation. Nicotine, the major component of cigarette smoke, may weaken host defenses to the bacterial invasion induced by plaque.

Keywords: periodontal disease; smoking; periodontitis; gingivitis; nicotine

INTRODUCTION

Cigarette smoking represents a major preventable cause of human disease.[1] Tobacco smoke contains over 3800 chemicals, including carbon monoxide, hydrogen cyanide, and reactive oxidizing radicals, and sixty of these chemicals are known or suspected to be carcinogens.[2] Smokers have significantly elevated risks of all-cause mortality and developing a variety of pathological conditions.[1] A direct causal relationship between smoking exposure and the prevalence and the severity of periodontal disease has been firmly established (American Academy of Periodontology 1996, Grossi et al. 1994).[3,4] According to the National Health and Nutrition Examination Survey III, smokers were four times as likely to have periodontitis as persons who had never smoked after adjusting for age, gender, race/ethnicity, education, and income/poverty ratio. The use of tobacco products, in general, and smoking products, in particular, is the major preventable risk factor for the initiation and progression of periodontal diseases. [5-7] A meta-analysis of data from six such studies involving 2361 individuals indicated that current smokers were nearly three times more likely to have severe periodontitis than nonsmokers. The detrimental impact of long-term smoking on the periodontal and dentate status of older adults has been clearly demonstrated.[8] The most marked difference between smokers and nonsmokers in probing depths or attachment loss occurs in the maxillary lingual area and mandibular anterior teeth, suggesting a local effect of smoking.[9] It has also been firmly established that smoking cessation is associated with decreased mortality, lower risk of developing a variety of diseases, and increased life expectancy.[1]

Clinical Parameters Of Periodontium Affected By Smoking Gingival Diseases

Gingivitis

Several cross-sectional investigations have indicated that smokers may present with lower levels of gingival inflammation to a specific level of plaque than nonsmokers. This was evidenced using both the gingival index and the dichotomous evaluation of bleeding on probing.[1]Nair et al. followed 27 individuals for 4–6 weeks during a verified successful period of quitting smoking and found bleeding doubled (from 16% to 32%) during this period.[10]

Acute Necrotizing Ulcerative Gingivitis:

Pindborg (1947) was one of the first investigators to study the relationship between smoking and periodontal disease. He determined that tar in the smoke exerted a direct irritating effect on the gingiva giving rise to gingivitis and that nicotine could cause contraction of the capillaries, thus interfering with the nutrition of the gingiva which consequently became less resistant to infection.[11]

Periodontitis:

Smokers have a higher proportion of sites with deeper probing depths and clinical attachment loss compared with nonsmokers.[4,12,13] The observed effects have been confirmed in different studies and in different populations after correcting for a variety of potential confounders.[14]

Cigarette Smoking as a Risk Factor for Periodontitis :

Although the direct cause for periodontitis is oral bacterial infection, its progression and severity depend on a number of genetic and environmental factors.[14] Several epidemiological studies in different population demonstrate a relationship between smoking and periodontal disease.[15,16] Cigarette smoking is arguably the strongest behavioral risk factor for the incidence and progression of periodontitis.[17] It is also important to note that although nonsmokers universally respond better to periodontal treatment than do smokers, there is nevertheless substantial evidence of clinical improvement in smokers after treatment, indicating that smoking as a risk factor will compromise rather than prevent tissue healing.[18] Some of the mechanisms by which smoking affects periodontitis are elucidated in Table 1.[19]

TABLE 1: HOW SMOKING ALTERS THE ETIOLOGY AND PATHOGENESIS OF PERIODONTAL DISEASE

PROPOSED MECHANISMS FOR THE NEGATIVE PERIODONTAL EFFECTS OF SMOKING[19]
Increased prevalence of periopathogens
Difficulty in eliminating pathogens by mechanical therapy
Vascular alterations
Altered fibroblast attachment and function
Negative local effects on cytokine and growth factor production
Altered neutrophil function
Decreased IgG production
Decreased lymphocyte proliferatio

Effects Of Nicotine on The Periodontal Tissues :

While nicotine is the primary psychoactive component, and addiction to it is the main reason for people subjecting themselves to frequent and high doses over many years, one must appreciate that tobacco smoke contains thousands of different compounds. Many of these are directly noxious/poisonous to living organisms and cells, and nicotine may be unfairly blamed for most of these properties. Moreover, it is also very important to appreciate that most of the harmful effects of tobacco products will result from systemic exposure through absorption in the lungs rather than topical absorption in the oral cavity[21]. A regular heavy smoker exposes himself/herself to these compounds many times per day for several minutes at a time. Although increasing evidence is being presented for the harmful effects of passive smoking, the periodontal literature is generally confined to active smoking. Many smokers develop the habit in their teenage years and continue it throughout their life. No other drug is administered so frequently or over such a time period as smoking. This is to emphasize the fact that the detrimental effects on the periodontium are derived from long term chronic exposure and bear little relationship with the effects that can be measured on a single exposure. Cotinine, a metabolite of nicotine, can be measured in the serum/plasma and saliva, and is a better measure of tobacco smoke exposure as it has a longer half-life than nicotine (18 h compared with 1 - 2 h). Smokers would be expected to have serum cotinine levels of over 14 ng/ml, and this could be as high as 1000 ng/ml. Resting plasma nicotine levels are much lower (5 - 50 ng/ml), and are maintained by the individual to satisfy their craving for nicotine. Because nicotine is so rapidly absorbed from the lung and transport to the brain is rapid, very high peak levels can be measured in the brain. It is important to understand these variations in relation to levels tested in in-vitro experiments . Some early studies suggested that smokers experienced less gingival bleeding than non-smokers .[22,23] This observation was confirmed in a comparative study of 10 heavy smokers (at least 20 cigarettes per day) and 10 non-smokers who had similar levels of periodontitis .[38] These authors cited the potential vasoconstrictive effect of nicotine previously reported by Clarke .[20] The reduced bleeding on probing was further demonstrated in a study by Bergstrom & Bostrom .[24] Gingival bleeding was lower in 130 smokers (median [interquartile range, IQR] bleeding score 19.0 [13.0]) than 113 non-smokers (median [IQR] bleeding score 32.0 [20.3]), with similar levels of periodontitis ($p < 0.001$). Tobacco smoke contains carbon monoxide, which is detectable in the breath of smokers and can be used to assess compliance in quit-smoking programmes .[10] Oxygen saturation of haemoglobin is affected and attempts have been made to measure this in the gingival tissue of smokers and non-smokers. Hanioka and coworkers [40] showed variable results. In healthy gingiva, smokers did appear to have lower oxygen saturation, determined using tissue reflectance spectrophotometry, whereas in the presence of inflammation, the converse was shown. The same group of workers [25] also examined the oxygen tension in the pockets of 34 non-smokers and 27 heavy smokers with mild to moderate periodontitis. They showed that the pocket oxygen tension was significantly lower in smokers (mean 21.9 mm Hg) compared with non-smokers (mean 33.4 mm Hg [$p < 0.0001$]). This could have an impact on the pocket microflora. The vasculature has also been examined in histological and immunocytochemical studies. In a very limited study of one histological section from three smokers and four non-smokers, Mirbod and coworkers [26] found that there were a high proportion of small vessels compared with large vessels in smokers compared with non-smokers, but no difference in the vascular density. The region chosen for study was the connective tissue beneath the external gingival epithelium, which was therefore remote from the pocket wall/sulcus and the inflammatory lesion. Sonmez and colleagues [27] did not show differences in the density or number of Factor VIII labelled vessels in gingival tissues obtained at the time of periodontal surgery from 38 smokers and 36 nonsmokers. The orientation and location of the specimens were not described. A more comprehensive

histological comparison of smokers and non-smokers was presented by Rezavandi and coworkers [28] who labelled the vessels by immunocytochemical staining to the von Willebrand factor, ICAM-1 and E-Selectin. They reported that a significantly larger number of vessels were observed in inflamed tissues of nonsmokers than smokers ($p < 0.05$). Baab & Öberg [29] were the first researchers to question the vasoconstrictive action of nicotine (from cigarette smoking) on gingival tissues. In a Laser Doppler Flow (LDF) study of 12 young regular smokers, they showed that gingival blood flow rose by about 25% during smoking, was maintained for 5 min. and then gradually declined to baseline values. This was associated with an increase in heart rate and systolic and diastolic blood pressure. They confirmed that the blood flow to the skin of the forearm did decrease slightly, demonstrating the differences in response between peripheral skin responses and those in the head and neck. It was interesting to note that 3 of their subjects felt light headed after smoking, suggesting that the inhalation dose was greater than they normally experienced. Animal studies have shown that local nicotine delivery negatively impacts bone healing [30], which may be related to inhibited expression of various growth factors [31] and delayed revascularization [32]. These findings might help explain the diminished treatment response to surgical periodontal procedures, especially that involving tissue regeneration. This means that tobacco smoking may exert a masking effect on gingival symptoms of inflammation, which might give smoking patients a false sense of assurance of gingival health [33]. Smoking upregulates the expression of pro-inflammatory cytokines, such as interleukin-1, this contributes to increased tissue damage and alveolar bone resorption [34]. Interleukin-1 genotypepositive smokers are more susceptible to severe adult periodontitis [34].

Effect of Smoking on the Microbiology of Periodontitis

Studies have failed to demonstrate a difference in the rate of plaque accumulation of smokers compared with nonsmokers, suggesting that if an alteration in the microbial challenge in smokers exists, it is due to a qualitative rather than quantitative alteration in the plaque. Several studies report a similar microbial profile of dental plaque in smokers compared with nonsmokers with regard to the ability to detect suspected periodontal pathogens in the subgingival plaque biofilm.[35-37] However, in smokers, such suspected periodontal pathogens are recovered in shallower areas without clinical periodontal breakdown.[38] More recent studies that utilize molecular techniques capable of characterizing previously unknown bacteria or those that are difficult to culture have provided evidence of distinct microbial profiles and patterns of biofilm colonization in smokers and nonsmokers.[39,40] Winkelhoff and Tijhof [41] compared the subgingival microflora of treated and untreated smokers and nonsmokers. They found the most pronounced microbiological characteristics of smokers appeared to be the presence of Bacteroidesforsythus, Peptostreptococcus micros, Fusobacterium nucleatum, and Campylobacter rectus in the absence of Actinobacillus actinomycetemcomitans and Porphyromonas gingivalis. In addition, these pathogenic bacteria were more prevalent in the maxilla than the mandible.[42]

Impact of Smoking on the Physiology:

The clinical signs of inflammation are less pronounced in smokers when compared with nonsmokers. Although no significant differences in the vascular density of healthy gingiva have been observed between smokers and nonsmokers, the response of the microcirculation to plaque accumulation appears to be altered in smokers when compared with nonsmokers.[43] Fewer crevicular polymorphonuclear neutrophils (PMNs) and less crevicular phagocytosis could conceivably decrease the release of lysosomal enzymes and thus decrease the level of inflammation in the superficial layers of the periodontal tissues. Smoking-induced chronic hypoxia of periodontal tissues causes greater severity of periodontal disease seen in smokers.[44] Trikilis et al. found that subgingival temperatures are lower in smokers than nonsmokers. The decreased subgingival temperature in smokers might reflect the reduced activity of periodontal cell.[45] Tobacco and some of its components such as nicotine have been found to have adverse effects on cells of the periodontium, including gingival fibroblasts and cells of the immune system. An in vitro study done by Tanur et al. showed that the nature of cell attachment to root surfaces is altered by nicotine.[46] Cigarette smoke condensate may interfere in myofibroblastic differentiation. Results of the study by Silva et al. showed that cigarette smoke, but not nicotine, may significantly alter cell viability, cell migration, and myofibroblastic differentiation in gingival mesenchymal cells.[47] Nicotine also caused a dose-dependent inhibition of fibronectin and Type I collagen production. The inhibition of collagen production by nicotine was accompanied by ~700 and 400% increase in collagenase activity at nicotine concentrations of 0.075% and 0.05%, respectively. Nicotine may stimulate transcription of the collagenase gene, either directly or through inducing the production of cytokines by the fibroblasts themselves.

Impact of Smoking on Immunology:

Periodontitis is associated with an alteration in the host-bacterial balance that may be initiated by changes in the bacterial composition of subgingival plaque, changes in the immune response, or a combination of both elements.[48] A number of studies have shown that cigarette smoking may affect the host response by altering the immune response in local tissue. Smoke exposure impairs f-actin kinetics, resulting in the damage of the neutrophil cytoskeleton (Ryder et al. 1998).[48]

Effect on Oral Polymorphonuclear Neutrophils:

Neutrophils, obtained from the peripheral blood or saliva of smokers, have been shown to demonstrate functional alterations in chemotaxis, phagocytosis, and oxidative burst.[49,50] One possible mechanism for this elevated neutrophil-mediated destruction may simply be the elevation of neutrophils in smokers seen in the peripheral blood which may lead to increased secretion of potentially tissue-destructive products. In addition, nicotine may prolong the lifespan of neutrophils in tissue by delaying the process of programmed cell death (apoptosis).[51]

Effect on Monocytes :

The effects of nicotine on monocytes were not restricted to inhibition of the production of oxygen radicals. It also interfered with secretion of the pro-inflammatory cytokine, interleukin 1β (IL-1β). In periodontitis, IL-1β activates fibroblasts and osteoclasts to destroy the periodontal ligament and the alveolar bone. Eventually, the immune response to prolonged infection by periodontal pathogens would overwhelm any short-term anti-inflammatory effect of nicotine.[52]

Effect on Circulating Polymorphonuclear Neutrophils :

Circulating PMNs from smokers have been shown to have normal phagocytosis but depressed chemotaxis when testing is performed rapidly after cigarette smoking. This effect is lost after overnight abstinence from smoking, suggesting the presence of a labile substance.[53]

Effect on Antibody and Lymphocyte Response:

Nicotine and the water-soluble fraction from whole cigarette smoke can suppress the in vitro secondary antibody response.[54] Salivary immunoglobulin A has been found to be significantly decreased in smokers when compared with nonsmokers.[55] Production of antibody essential for phagocytosis and killing of bacteria, specifically IgG2 levels to periodontal pathogens, has been reported to be reduced in smokers versus nonsmokers with periodontitis.[56]

Effect on Cytokines, Growth Factors, and Other Enzymes :

Elevated levels of tumor necrosis factor-α, prostaglandin-E2 , neutrophil elastase, and matrix metalloproteinase-8 have been demonstrated in the gingival crevicular fluid(GCF) of smokers.[57] Wendell et al. demonstrated that nicotine can directly stimulate human gingival fibroblast IL-6 and IL-8 production in vitro. In addition, combination of nicotine and lipopolysaccharide had a synergistic response, upregulating inflammatory cytokine production.[58] IL-4 production by peripheral blood mononuclear cells of smokers was significantly higher than that of nonsmokers (Byron et al. 1994).[59] Bergstrom et al. (2001) observed that for patients with periodontitis, the concentration as well as the total amount of GCF, α-2-macroglobulin and α-1-antitrypsin, was lower in smokers as compared to nonsmokers, which led to increased tissue damage due to increased activity of elastase and collagenase.[59]

How Smoking Effects the Response to Periodontal Therapy

Nonsurgical Therapy:

The majority of clinical research supports the observation that pocket depth reduction is more effective in nonsmokers than in smokers using nonsurgical periodontal therapy, including oral hygiene instruction, scaling, and root planing. In addition, gains in clinical attachment as a result of scaling and root planing are less pronounced in smokers than in nonsmokers.[60-66] Wan et al. found that at 12 months after nonsurgical therapy, smokers presented with a significantly higher percentage of residual pockets. In addition, smokers showed less probing pocket depth (PPD) reduction in sites with initial PPD ≥5 mm.[67] The inhibitory effect of smoking on treatment response is more pronounced at initially deeper sites.[68] Darby et al. found that nonsmokers with aggressive periodontitis had significantly greater probing depth reduction (2.4 mm) compared with patients with aggressive periodontitis who smoke (1.3 mm).[69] It can be concluded that smokers respond less well to nonsurgical therapy than nonsmokers. However, in the presence of excellent plaque control, these differences may be minimized.

Antimicrobial Therapy:

In a 9-month, placebo-controlled, randomized trial in which smokers and nonsmokers were treated by scaling and root planing with and without sub-antimicrobial doxycycline, Preshaw et al. concluded that adjunctive sub-antimicrobial dose doxycycline enhanced therapeutic outcomes in all groups with smokers taking doxycycline, showing approximately the same magnitude of clinical improvement as nonsmokers on placebo.[70] On the other hand, in studies where adjunctive systemic amoxicillin and metronidazole[71] or locally delivered minocycline microspheres[72] enhanced the results of mechanical therapy, there was a greater difference between the control and experimental treatments within smokers as compared to within nonsmokers. These and, in the case of tetracycline derivatives, anticollagenase activity. Unique regimens that sequence systemic antimicrobial therapy or combine local antimicrobial delivery with host modulatory therapy might offer clinicians and patients options that address microbial and host response alterations in smokers.[73]

Surgical Therapy :

The clinical benefit seen in nonsmokers following nonsurgical therapy has also been observed following surgical treatment (Ah et al. 1994).[74] The most impressive report of clinical attachment gain in nonsmokers (5.2 mm) compared with smokers (2.1 mm) was observed by Tonetti et al., who carried out guided tissue regeneration (GTR) of infrabony defects using Gore-Tex membranes and with a follow-up period of 1 year. They also concluded that higher plaque levels that are seen consistently in smokers compared with nonsmokers will also have influenced the clinical outcomes.[75] When expanded polytetrafluoroethylene

membranes were utilized in GTR procedures at recession sites, smokers had significantly less root coverage (57%) as compared to nonsmokers (78%).[76] The superior blood supply afforded by the subepithelial connective tissue graft might be more resistant to the effects of smoking as compared to the nonresorbable barrier membrane. However, root coverage following thick free gingival graft procedures is reportedly diminished by heavy cigarette smoking and there are conflicting reports on smoking's effect on the success of subepithelial connective tissue grafts.[76]

Implant Therapy:

The largest data set on the influence of smoking on implant success comes from the Dental Implant Clinical Research Group (DICRG) of the Department of Veterans Affairs, which is an 8-year, randomized, prospective clinical study that includes >2900 implants.[77] The 3-year data demonstrated that 8.9% of implants placed in smokers failed as compared to 6% in individuals who had never smoked or had quit smoking. The majority of implant failures in smokers occurred before prosthesis delivery; thereafter, the differences between smokers and nonsmokers tended to disappear.[78] A meta-analysis done by Bain reported that light smoking (average of 12 cigarettes/day) did not affect the success rate of either machined or dual acid-etched surface implants.[79]

CONCLUSION:

In view of the fact that smokers are two- to eight-fold more likely to have periodontitis than nonsmokers, smoking cessation should be an important treatment consideration for periodontal patients. This fact can be useful in patient education and may provide encouragement to patients contemplating cessation. Dental professionals are well positioned to provide smoking cessation advice to their patients because patients are likely to visit their periodontologists/dentists more often than their physician. Therefore, close collaboration of dentists/periodontologists and physicians is recommended in the treatment of smoking patients

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SP-12

Incidence Of Foreign Bodies In Maxillary Sinus - A Review

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Abstract: Foreign bodies in the maxillary sinus being it traumatic cause or iatrogenic injury are usually uncommon. Such Foreign bodies/objects (FB) maybe ingested into the maxillary sinus commonly through oral cavity or nasal cavity and its displacement shows an increasing incidence, especially due to increase in dental procedures such as dental implants, dental restorations etc. These foreign bodies often goes unnoticed and individuals report to clinician only when there is any sinusitis issue or nasal stuffiness or blockage or sometimes in cases with no symptoms, they get accidentally noted during an radiographic assessment for other purposes. This review is to discuss about the anatomy and physiology of maxillary sinus and about the various foreign bodies that can accidentally be ingested in maxillary sinus.

Keywords: Foreign bodies, Maxillary sinus, Caldwell-Luc, Sinusitis, Endoscopy

1. INTRODUCTION

Foreign bodies are objects or pieces of extraneous matter that enter the body accidentally or due to any trauma. Foreign bodies (FB) are occasionally found in paranasal sinus. Paranasal sinus includes four pairs of sinus namely maxillary sinus, ethmoidal sinus, frontal sinus and sphenoidal sinus. These are air-filled spaces within the maxillofacial region that consist of mucosal lining. They communicate with the nasal cavity and forms a unit. Therefore, any object penetrating the sinus can be possibly through means of either oral cavity or nasal cavity and infection in the upper respiratory tract can cause spread of infection to lower respiratory tract also. The possible causes for ingestion of foreign objects in these sinuses include accidental injuries like traffic accidents, explosions, gunshot injuries, metal objects, dental procedures or objects like fractured dental roots, dental implants, dental burs, endodontic materials, impression materials. Foreign bodies can either be superficial or penetrating type. Superficial foreign objects are usually easy to locate and remove it as it would be visible on inspection while objects that have penetrated into the paranasal sinus are more difficult to locate and remove. It is very important to determine if the position of these foreign bodies, whether they are near the vital structure or not. Hence proper investigations such as radiographic assessment need to be done before any surgical procedure followed by surgical retrieval of those objects from the paranasal sinus. Foreign bodies ingestion in dentistry are unusual but are often seen in the maxillary sinus among the various paranasal sinus that are reported. Various studies have reported such incidence leading to failure of the dental treatments. Hence it is important to be aware of risk of such incidents that can occur due to the dental procedures and be cautious. The aim of this review is to understand the anatomy of the maxillary sinus and to discuss about the various causes of foreign bodies reported previously in maxillary sinus and the management.

2. MAXILLARY SINUS

2.1 ANATOMY AND PHYSIOLOGY

The maxillary sinus begins to form during the 10th week of intra-uterine life. Ossification of the maxillary sinus starts during the 16th week, from lateral wall of the sinus proceeding towards the anterior wall by 20th week and the posterior wall by 21st week.[1] At birth, the sinus is approximately 10×3×4mm in dimension. In adult after full development the dimensions are reported as 40 × 26 × 28 mm with an average volume of 15 mL . Growth of the maxillary sinus is proportional to the growth of facial bones which occurs in various phases, the first phase at 3 years of life, the second phase taking place at 6-12 years of life and the third phase is the one after pneumatization of the maxillary alveolus, as the permanent molar and premolar teeth erupt displacing the floor of the sinus around 4–5 mm below the floor of the nasal cavity. [2,3] Various studies with the help of 2D and 3D scans state that the size of maxillary sinus development shows gender difference after 8 years of age and it develops till second decade in females and till third decade in males. Also it reported the mean volume of the fully developed maxillary sinus varies according to the ethnicity as reported and is usually larger in males than females. [4] These are paired sinuses, which are pyramidal in shape and are the largest of the paranasal sinus and are filled with air which lie within the maxilla.[5] The anterior wall of the maxillary sinus is formed by the facial surface of the maxilla and it has three landmarks 1) thin canine fossa, 2) infraorbital foramen, 3) infraorbital groove.[6] The posterior wall is covered by infra-temporal surface of the maxilla. The superior wall is covered by orbital floor with the infraorbital groove running through it [6,7,8] and the inferior wall is continuous with the alveolar process. The medial wall forms the lateral wall of nasal cavity and the lateral wall is contiguous inferiorly with the buccal aspect of alveolar ridge.[9]

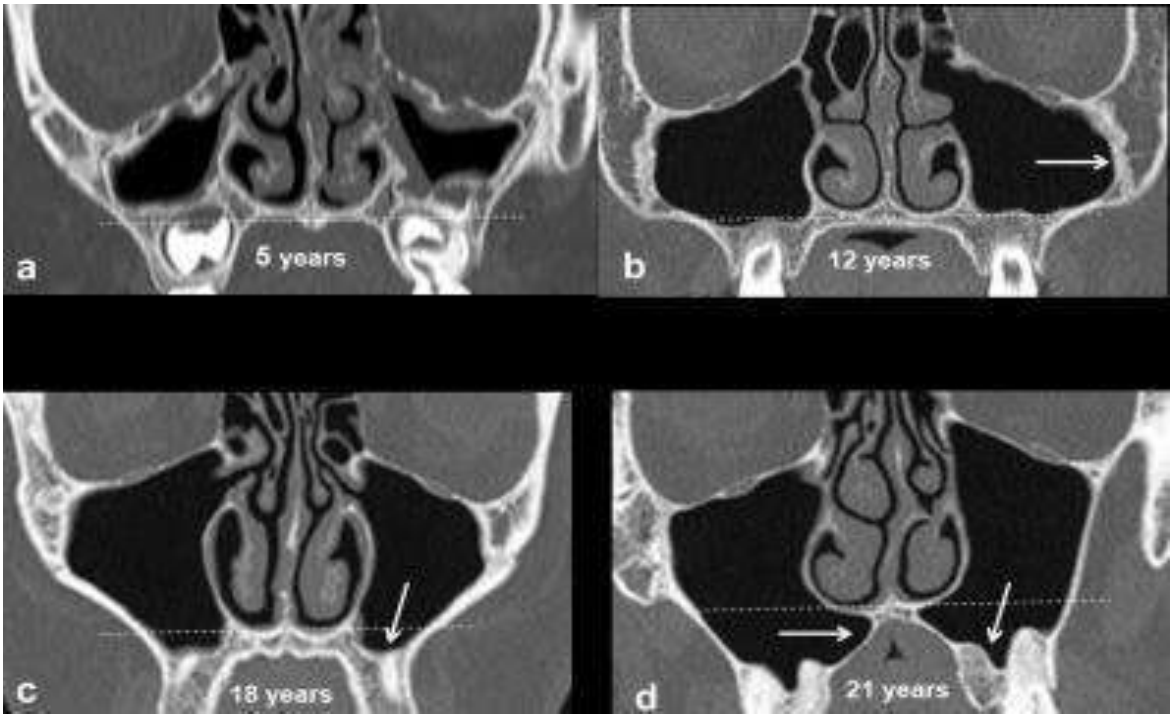

Fig 1 : Development of the maxillary sinuses. Up to the age of 12 years, growth of the maxillary sinus is predominantly in a lateral direction (white arrow in b) and after that the sinus expands inferiorly below the level of the nasal floor (white arrows in c, d)Image courtesy : Whyte A, Boeddinghaus R et al: *Dentomaxillofac Radiol* [9]

The vascular supply of maxillary sinus is primarily derived from the branches of maxillary artery such as posterior superior alveolar artery, infraorbital artery, greater palatine artery and sphenopalatine artery.[6] The maxillary sinus receives general sensation by innervation from the infraorbital and anterior, middle and posterior superior alveolar branches of the maxillary division of trigeminal nerve.[6] Most sensory innervation is provided by the posterior superior alveolar branch, which usually has two to three branches. The lymphatic drainage of maxillary sinus is through the infraorbital foramen or through the ostium and then to the submandibular and deep cervical lymph nodes. The maxillary sinus are lined by bilaminar mucoperiosteal membrane and the membranes has three layers, the periosteum, connective tissue and ciliated pseudo stratified columnar epithelium. The mucosa bound to the underlying periosteum is called as mucoperiosteum and is commonly referred to as the Schneiderian membrane. It also contains cilia and a protective mucous layer secreted by goblet cells in the epithelium and mucous glands in lamina propria which together constitutes the mucociliary apparatus. It acts as a defensive mechanism of respiratory tract to protect inhalation of harmful pollutants, allergens or pathogens by trapping them with the mucus secreted. This mucus is secreted as as two layers, a thin watery layer to allow easy movements of cilia and the other thick sticky layer which helps to trap the airborne particles.[10] The cilia then moves the sticky layer along with the trapped particle to the sinus ostium which moves to the nose and to the nasopharynx.[10] Other uses include humidifying the heat dry air into cold moist air, minimize the bone mass of the skull and improve resonance of voice along with the other sinus.

2.2 FOREIGN OBJECTS IN MAXILLARY SINUS

Foreign bodies are seen rarely at times in the paranasal sinuses due to ingestion of various materials that enter the sinus through oral or nasal routes. Among the four pair of paranasal sinus, it is reported that 80% foreign bodies ingestion is in maxillary sinus. The most common causes include the iatrogenic causes, which results due to dental, ophthalmic procedures that constitutes upto 60% of the cases. The other cause is the traumatic incidents, which can be due to external trauma to the sinus region, or indirect trauma to the palate, orbit or nasal injury which accounts upto 25% of the cases.[11] In dentistry, because of antral perforation during the dental procedure involving the apical surgery of maxillary tooth, they often result in a pathway for the entrance of foreign bodies into the maxillary sinus.Various foreign bodies can include dental implants, root apex of the tooth, impression materials, dental burs, broken dental instruments, wooden sticks, toothpicks, needles, pins, glass items, metals, and bullets.

2.2.1. *Implant Displacement In Maxillary Sinus*

Initially in 1981, studies reported that an implant which is longer than the remaining bone could be displaced or ingested into the maxillary sinus.[12] Since then, incidence of implant penetration into the maxillary sinus have been reported regularly which can be proportional to the increase in number of implant placement. Despite its drastic success rate, such incidents happen during the improper surgery, unskilled surgeon, poor implant stability, failure or unsuccessful regeneration of bone following previous surgery in the floor of the sinus as reported.[13] Moreover poor implant stability can cause micro movement of implant and poor implant fixation causes osseointergration, that results in displacement of implants in the later stage.[14] The other possible cause includes incorrect masticatory forces exerting destructive force, an over-sized prosthesis, malocclusion caused by poor retention of prosthesis and more commonly peri-implantitis which destroys the bone, surrounding the implant and thus it results in unsuccessful osseointergration.[15,16] Association between implant displacement and the insufficient height of the maxillary alveolar bone have also been discussed in various studies but it is concluded that the insufficient height can be a risk factor but not a dependent factor for implant displacement.[17] Biglioli and Chiapasco reported that 33% of the 36 implants got displaced into the maxillary sinus due to sinus floor elevation before implantation and Galindo-Moreno reported that 53.3% of implant got displaced similarly.[18] Evidence shows that dental implants in maxillary sinus can result in infection such as sinusitis to serious problems like fungal infection or cancer and hence proper removal of such implants are very important.[19,20]

2.2.2. *Endodontic Materials In Maxillary Sinus*

The close anatomical relationship of the maxillary sinus with the roots of the maxillary molars, premolars and occasionally canines, makes it susceptible to morbid situation resulting from damage due to various dental interventions done. Maxillary sinus involvement may occur during the endodontic treatment due of the extension of endodontic instruments and materials beyond the apices of teeth. On of the study revealed that 14% of the patients (57 cases) showed endodontic materials in sinus out of which 82.5% were root canal filling material (47 cases), impression materials and restorations. The other cases included dental burs, endodontic files, drills bits and other endodontic instruments.[21] One of the case report recorded accidental fracture of gates-gladden drill during the root canal treatment which on radiographic examination was located inside the maxillary sinus.[22]

2.2.3. *Tooth In Maxillary Sinus*

The anatomical relation between the maxillary teeth and maxillary sinus is a complex one, owing to the variable extension of the sinus. Approximately in 50% of the population, the maxillary sinus is in close relation to the roots of the maxillary molar and premolar teeth, particularly deepest point of the maxillary sinus is located close to the first and second permanent molars with the dehiscent rate of 2.2% and 2% respectively. In rare cases the sinus floor can extend as far as the region of the canine root.[23] However due to extensive air spaces, the premolars and the canine teeth may also be exposed into the sinus. Also during extraction, accidental penetration of tooth or broken tooth have also been reported by various studies.

TABLE 1 : Accidental causes of foreign bodies in maxillary sinus

Type of foreign bodies	Site of foreign bodies	Methods of injury	Complication	Management	Reference
Piece of glass	Left maxillary sinus	Road traffic accident	Sinusitis Nasolacrimal duct obstruction	Functional Endo-scopic Sinus Surgery (FESS) and Endoscopic dacryocystostomy	Nataraj et al [24]
Third molar tooth	Right maxillary sinus	Congenital	Sinusitis	Caldwell-Luc	Gurkan et al [25]
Hand sewing needle	Right maxillary sinus	Voluntarily introduced by the patient	Sinusitis	Removed with magnetic iron under local anesthesia	Shao et al [26]
Pressure cooker nozzle	Maxillary sinus	Blast injury	None	Taken out by manipulation with a long- toothed forceps	Agarwal et al [11]
Shell cases	Maxillary sinus	NA	None	Caldwell-Luc	Saeed et al [27]
Wooden toothpick	Left maxillary sinus	Un- known	Unilateral chronic sinusitis	Combined endoscopic and Caldwell-Luc	Sahin et al [28]
Nail	Right maxillary sinus	A piece of metal flew into his right cheek	None	Endoscopy	Pang et al [30]

Table 2 : Iatrogenic causes of foreign bodies in maxillary sinus

Type of foreign bodies	Site of foreign bodies	Methods of injury	Complication	Management	Author
Dental implant	Right maxillary sinus	During multiple implantations	Sinusitis	Caldwell-Luc	Mumtaz et al [31]
Gates- Glidden drill	Left maxillary sinus	During endo- dontic treatment	None	Caldwell-Luc	Basturk et al [32]
Root canal filling with extrusion of endodontic obtu- ration material	Right maxillary sinus	During endodontic treatment	None	Open surgical approach	Tanasiewicz M et al [33]
Tooth root	Right maxillary sinus	During extraction	Sinusitis	Middle meatal antrostomy (MMA)	Saruhan N et al [34]
Dental silicone impre- ssion material	Left maxillary sinus	NA	Sinusitis	Transnasal endoscopy	Deniz Y et al [35]
Dental implant	Left maxillary sinus	During dental extraction and implantation	None	Middle meatal antrostomy (MMA)	Sireci et al [36]
Surgical bur	Maxillary sinus	During extraction	None	Caldwell-Luc	Smith et al [37]
Zinc oxide cement	Maxillary sinus	NA	None	Caldwell-Luc	Batista et al [29]

2.3 IMAGING TECHNIQUES

Radiographic examination of the maxillary sinus may be carried out by a wide variety of options like periapical radiographs, occlusal radiographs, panoramic radiographs, paranasal sinus views and other facial views to confirm or rule out any pathology of the maxillary sinus. On periapical radiographs, the maxillary sinus border appears as a thin, delicate radio-opaque line and is seen as a fusion of lamina dura and floor of sinus. The disruption of the continuity of the lamina dura in the periapical area is the first sign of periapical pathology. The technique of 2-dimensional panoramic imaging was introduced in the first half of the 20th century. It is especially used in the initial diagnostic phase of the maxillary sinus to its pathological conditions. In panoramic radiography, the central radius goes almost straight toward the longitudinal axis of the molars resulting in minimal projection error. Furthermore, local swelling of the sinus membrane and opacities can be diagnosed.[38]

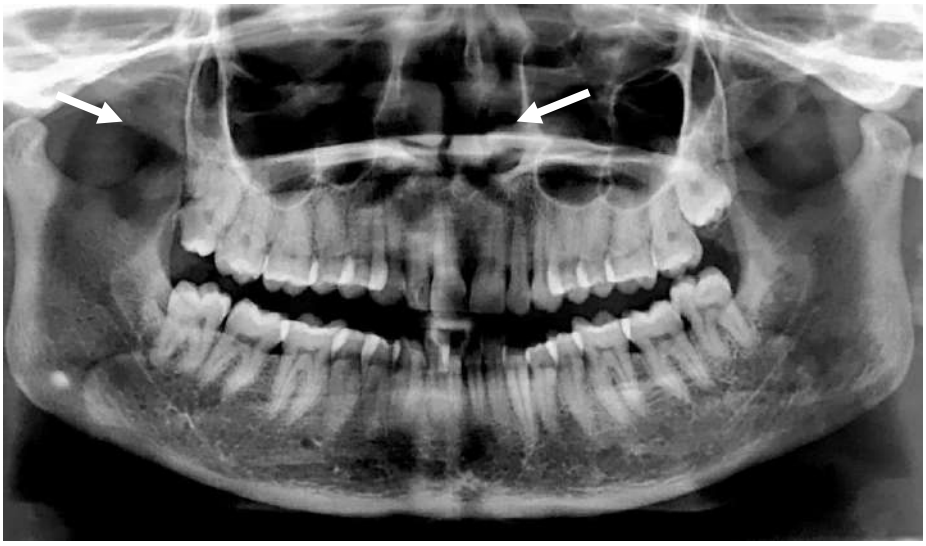

Fig 2: Panoramic radiograph, White arrows showing maxillary sinuses

Computerized tomography (CT) and magnetic resonance imaging (MRI) have become increasingly important for evaluation of sinus pathologies. They provide multiple sections through the sinus at different planes and thus contribute to final diagnosis and determine the extent of the disease.[39] These 3-dimensional imaging techniques take coronal and axial sections, since coronal sections through dental fillings, crowns and metallic restorations can result in artifacts, axial sectioning is also carried out. Another imaging technique included Cone beam computerized tomography (CBCT). In one of the studies involving CBCT and panoramic radiography, it was reported that there is a moderate risk for misdiagnosis of the maxillary sinus, if panoramic radiography is used alone rather than CBCT is used and also panoramic radiography led to false-negative and false-positive findings

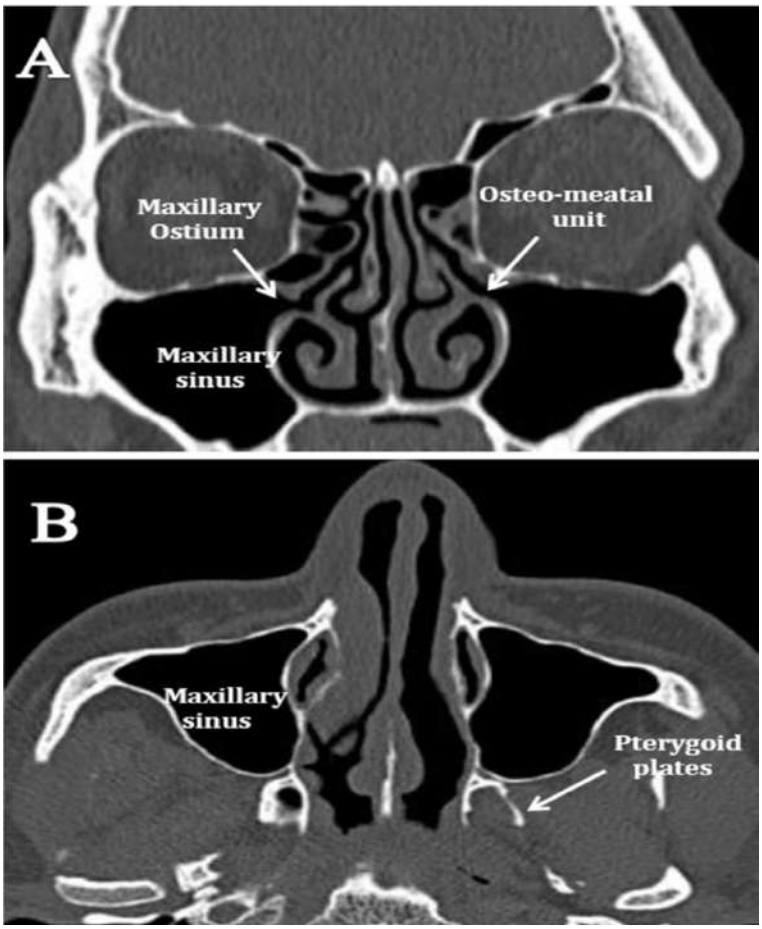

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Fig 3: Computerised tomography, (A) Coronal CT image of normal maxillary sinus and ostium (B) Axial CT image of normal maxillary sinus Image courtesy : Abhay G. Kakade ; MVP Journal of Medical Sciences [43]

Additional information can be obtained with the help of specialised skull views.[40] The occipito-mental or Water's projection is optimal for the visualisation of the paranasal sinuses, including the maxillary sinuses. Other than that submentovertex, postero-anterior and lateral skull views can also show the maxillary sinus towards some extent. But unfortunately, these specialised skull views have low rates of sensitivity and hence are replaced by computerised tomography (CT). Ultrasound is another safe, non-invasive technique that has been reported to diagnose the sinus pathologies and shows that in adults, ultrasound was 90% and radiography was 82% accurate in detecting fluid in maxillary sinus. Various authors have concluded that ultrasound also provides an excellent method of screening the sinus pathologies at comparatively low cost than that of other imaging techniques.

3. MANAGEMENT

3.1 Caldwell - Luc Technique

The Caldwell-Luc operation is a well-established procedure for removal of foreign bodies from sinus and other sinus pathologies. This operation was considered as a prime surgical management before the development of the antibiotics and endodontic surgery. The Caldwell-Luc approach opens the canine fossa and allows access to the foreign body inside the maxillary sinus. Recently Endoscopic sinus surgery is an arising choice of treatment now-a-days rather than the Caldwell-Luc procedure. Despite the success of endoscopic surgery, various evidence indicate use of Caldwell-Luc operation as it provides good access to the sinus, peri-sinus, and pterygo-maxillary fossa and also it can provide a wide access to foreign bodies that cannot be removed endoscopically because of the size of the object and displacement. If implant displacement has

caused an oro-antral fistula, then an intraoral approach, such as the Caldwell-Luc approach, is essential to close the oro-antral fistula.[41]

3.2 Endoscopic Surgery

Endoscopic sinus surgery has currently been replacing Caldwell-Luc procedure because excessive tears of the maxillary sinus mucosa are less likely in this method and it is less invasive than the Caldwell- Luc approach, reducing injuries or bleeding in the mucosa.[42] Removal of the foreign bodies using endoscopy is classified into two categories which can be an approach from the nasal cavity or an approach from the oral cavity. Nasal approach is done via natural ostium and it is minimally invasive. Yet the limitation of this approach include size of the foreign bodies.[42] In oral approach, a small incision is made in the canine fossa, following which an endoscope is used. This is also referred to as functional endoscopic sinus surgery.[42] It is comparatively better than nasal approach and is minimally invasive with low incidence of complications.

3.3 Lateral Window Technique

In this technique a full thickness flap is elevated to reveal the lateral sinus wall of maxilla, the sinus membrane is elevated, then on the lateral wall of the sinus, a window is created. It then allows the insertion of graft material to be placed or sometimes used to extract the foreign bodies. This is usually used in sinus augmentation or implant placement procedures. But it is also reported to be used for foreign bodies removal from maxillary sinus.

3.4 Middle Meatal Antrostomy

MMA is a surgical procedure which is done by enlarging the opening (ostium) of the maxillary sinus followed by surgical intervention. The three main goals to accomplish during this technique is to remove the uncinate process, find natural opening into the maxillary sinus, enlarge the opening followed by extraction of the foreign bodies. Though this method is used in some patients, it is not the best due to a high failure rate without guarantee of better surgical outcomes.

4. CONCLUSION

The displacement of foreign bodies into the maxillary sinus occurs unexpectedly and its is also difficult to manage. In most of the patients these foreign bodies in sinus goes un-noticed and are usually detected when the patients comes with unexplained complain of rhino-sinusitis, or as an accidental finding during radiological examination. And when it is detected, it is very important to remove the object or it can lead to various complications like chronic sinusitis, fungal infections or inflammatory reactions. Various methods are available to extract the foreign body from sinus based of the size, shape and location of the objects. Thus is it important to be aware of such incidents in general or private practise for early diagnosis and management.

5. CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-13

A Unusual Case Of Bifid Mandibular Canal In Down Syndrome Patient – An Accidental Finding

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Abstract: Bifid mandibular canals are anatomical variations in the mandible. They are often unrecognised in the radiographic assessment. Presence of bifid mandibular canals can pose various complications during any surgical procedures in mandible which includes extraction of mandibular molars, implant placements and any other surgery of mandible. Also sometimes an extra mandibular canal may be a cause of inadequate anaesthesia during surgical procedures. Thus it is important to detect these anatomical variations through radiographic assessment and give special attention during the treatment protocol. On the other hand , Down syndrome is a common genetic disorder, which is characterized by the presence of an extra copy of chromosome 21 (trisomy 21). There have been various craniofacial features and dental anomalies recorded in Down syndrome but the presence of bifid mandibular canal have not been recorded in these patients. Hereby, we record a case of Down syndrome patient with the presence of bifid mandibular canal.

Keywords: Bifid mandibular canal, Down syndrome, Anatomical variation, Panoramic radiograph, Foramen.

1. INTRODUCTION

The mandibular canal (MC) which is sometimes also called as inferior nerve canal, is a prominent anatomical structure of the mandible. This canal passes from mandibular foramen to the mental foramen and it transmits inferior alveolar artery and inferior alveolar nerve (IAN) , a branch of third division of the trigeminal nerve. Dental and incisive branches leave the inferior alveolar nerve within the canal to supply all the mandibular teeth and its adjacent structures such as lower lip, chin, and soft tissues anterior to mental foramen. Within the canal, the alveolar nerve is approximately 4 mm in thickness.[1] One of the unusual and interesting anatomical variations that we may come across in the mandible is bifid mandibular canals (BMCs) which can lead to difficulties during performing mandibular anaesthesia or extraction of mandibular third molar, placement of implants, and surgery.[2]. " Bifid " is a term derived from latin word which means a cleft dividing into two branches or two parts. Among various anatomical variations of mandible, Bifid Mandibular Canals (BMCs) is a variation that sometimes get un-noticed by the dental practitioners. These canals originate at the mandibular foramen and may have neuromuscular bundle for each. Reports suggest that the possible cause of the formation of these bifid mandibular canals are incomplete fusion of the inferior dental nerves during embryogenesis. The presence of these anatomic structures has its significant clinical implications. Awareness and knowledge about these mandibular canal variations help to prevent complications that may arise due to damage of the BMC during any surgical procedure.[3] There are several complications that can occur due to BMCs such as traumatic neuroma, paraesthesia, anaesthesia and bleeding are all possible complications.[4]. The existence of these bifid mandibular canals can be appreciated by anatomical studies or by radiographic studies and it has been reported in various radiographic studies such as Orthopantomogram (OPG), Computed Tomography (CT), Cone Beam Computed Tomography (CBCT) with the occurrence rate of 0.08% to 0.95%. One of the panoramic radiographic study reported that the incidence of this BMCs has been variably reported as 0.4%, 0.08%, and 0.9%.[5] In contrast to panoramic radiograph, computed tomography and cone-beam computed tomography allows 3-dimensional insights of the canal but with the disadvantage of being costly and higher radiation. There are various types/patterns of mandibular canals. Historic classifications of BMCs has been proposed by Nortje in the year 1977 and another classification by Langlais in the year 1985 (Table I). Both the classification described the distinctive variations of BMCs large enough to be detected with panoramic radiographs. The most recent classification of BMCs using CBCT was suggested by Luangchana in the year 2019 (Table 1).

TABLE 1 : CLASSIFICATION OF BIFID MANDIBULAR CANALS

AUTHORS	TYPES	DEFINITION
Nortje (1977)	Type I (most common)	Two canals originating from single mandibular foramen, usually of same size
	Type Ia	The lower canal is sometimes smaller
	Type Ib	The upper canal is the smallest of the two canals
	Type II	Short upper canal extending to 2nd or 3rd molar
	Type III (least common)	Two canals originating from two mandibular foramina, but joining together in the molar region to form one canal
	Type IV	Is a double-canal variation in which the supplemental canals arise from the retromolar pad area and join the main canals in the retromolar areas.
Langlais (1985)	Type I	Represents unilateral or bilateral bifid canals that extend to the mandibular third molar area or the immediately surrounding area

	Type 2	Includes unilateral or bilateral bifid canals that rejoin within the ramus of the mandible
	Type 3	It is a combination of types 1 and 2
	Type 4	Two canals, each of which originates from a separate mandibular foramen, join to form one larger canal
Luangchana (2019)	Type A	Superior type: single or multiple canals branching superiorly from the main MC
	Type B	Forward type: BMC coursing forward and running lower than apices of teeth (B1 not merging, B2 merging with MC)
	Type C	Plexus type: branching plexus from MC
	Type D	Anterior extension type: branching from mandibular incisive canal (D1 single or series of canals; D2 plexus of canals)

Bifid mandibular canal is an anatomical variation that has been reported to occur in various population in normal patients or patients with any other co-morbidities but till date no literature has recorded its occurrence in down syndrome patient. The purpose of this case report is to present an accidental finding of Bifid mandibular canal in a patient with down syndrome.

2. CASE REPORT

A 35-year old female patient who had Down syndrome reported to the dental OPD with the complaint of missing tooth in upper and lower arch and removal of the cap in upper front tooth region and wants replacement. The patient had moderate mental retardation but was able to understand, communicate and respond to us. No other systemic complications were reported. Dental history reveals prosthetic treatment and root canal treatment 5 years back. Family history revealed that mother was diabetic and no other family members and relatives were affected with Down syndrome.adverse habits revealed tongue thrusting habit and mouth breathing habit. On extra-oral examination, the patient had brachycephalic skull, slanting palpebral fissure, depressed flat nasal bridge, hypertelorism, short neck, clinodactyly, skeletal class III, and lip incompetence. On intra-oral examination, patient had poor oral hygiene, dental plaque and calculus, multiple missing tooth in relation to 11,12,13,27,31,32,33,41,42,43,44,45, dislodged fixed prosthesis in 21,62,63 (retained deciduous - 62,63), dental caries in 26, 37, generalised bleeding on probing with inflammation of gingiva and loss of attachment, grade I mobility in 25,26,34,35 and grade I mobility in 24,25, enlarged tongue with a small growth on the right lateral surface of the tongue measuring upto 2x2mm and high arched palate. Provisional diagnosis was given as Partially edentulous in relation to 11,12,13,27,31,32,33,41,42,43,44,45 and Dislodged fixed prosthesis in relation to 21,62,63. Other diagnosis included Dental caries in 26, 37, Macroglossia, Fibroma on right lateral surface of tongue, Generalised chronic periodontitis, Malocclusion . (Figure 1)

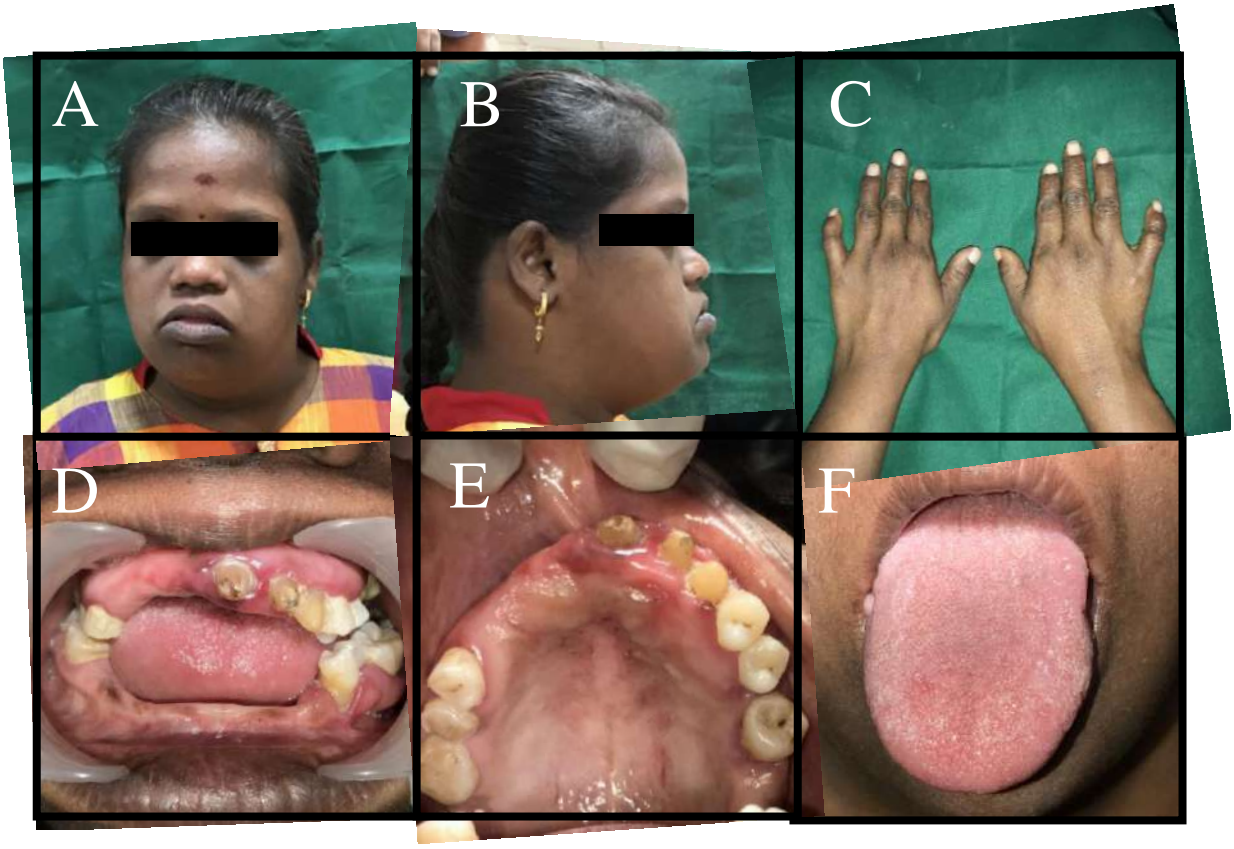

Fig 1 : 1A and 1B - front and side profile picture , 1C - left and right hands showing clinodactyly , 1D - Intraoral frontal picture, 1E - high arched palate, 1F - Macroglossia with fibroma on right lateral surface of tongue.

2.1 Radiographic Interpretation

On the routine investigation, patient was advised to take a panoramic radiograph for radiographic assessment which revealed multiple edentulous space in upper and lower arch, retained deciduous in relation to 62,63 with root resorption in 62, impacted 23, generalised horizontal bone loss suggesting generalised chronic periodontitis, saddle shaped mandible. The radiograph also revealed an anatomical variation of bifurcation of mandibular canal on left and right side. On the left side, two mandibular canals were observed which joins in the molar region and continues as single canal. On the right side, it reveals two mandibular canals which extends till the mental foramen as separate canals with branching of canal at the region of retromolar region. (Figure 2)

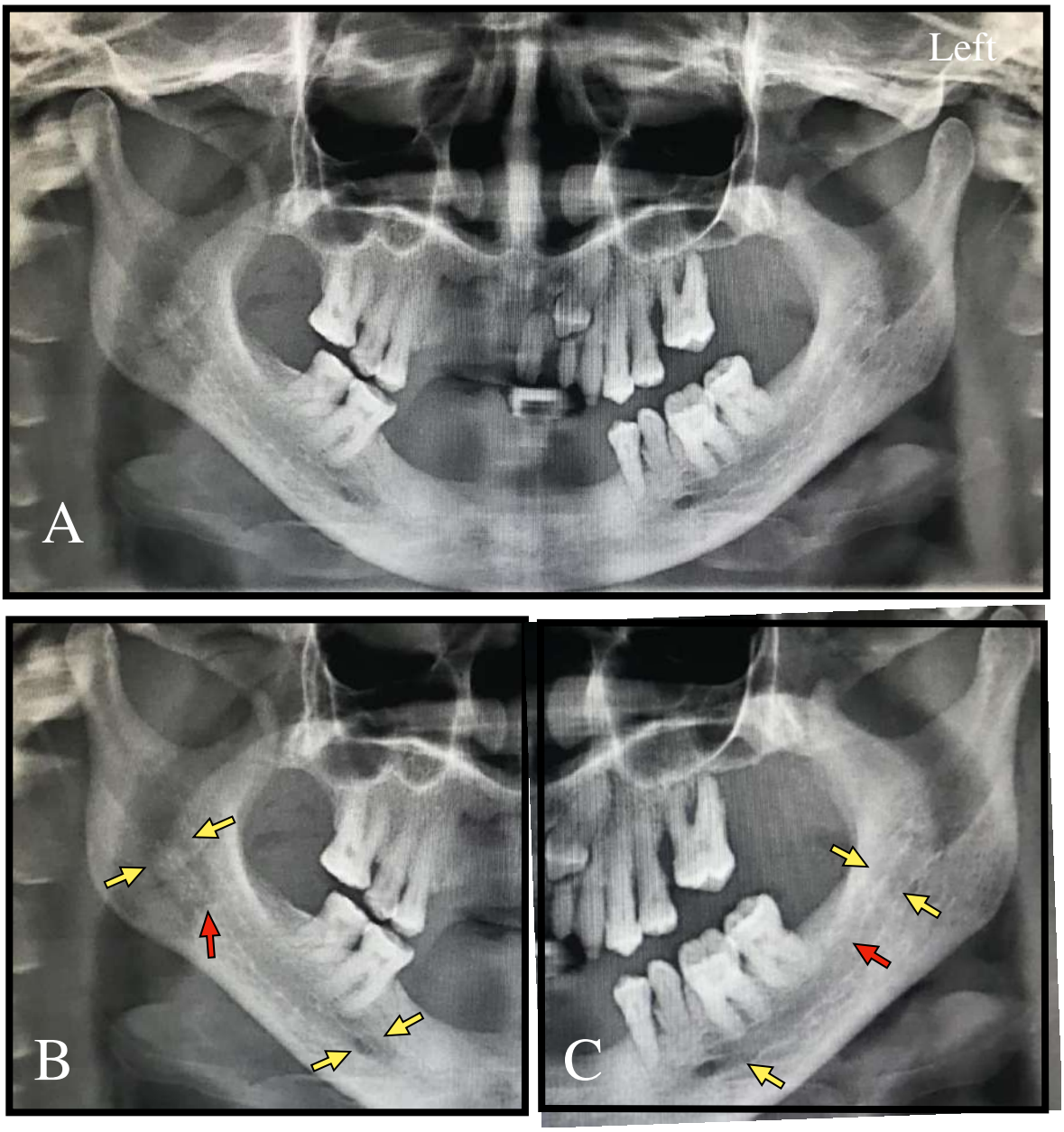

Figure 2 : Panoramic Radiograph , 2A - OPG reveals Bifid Mandibular Canals (BMCs) bilaterally, multiple partially edentulous space, impacted 23, retained deciduous 62,63, Generalised chronic periodontitis, 2B - yellow arrow shows right side BMC extending till mental foramen with branching at retromolar region shown by red arrow, 2C- yellow arrow shows left side BMC which extends till the third molar region and joins to form a single canal which is shown by red arrow.

3. MANAGEMENT

The patient was informed about the importance about the condition and advised to take a CBCT but the patient was unaffordable. Hence to continue with the management, patient was referred for surgical removal of the retained deciduous (62,63) and the impacted tooth (23) under local anaesthesia followed by prosthodontic replacement of edentulous space.

4. DISCUSSION

Mandibular canal protects an important neuro-vascular bundle responsible for carrying blood supply and sensitive activity to the lower teeth, lower lip, adjacent bone, gingiva and mucosa . Analysing the accurate position and the course of the mandibular canals and proper identification of its anatomical variations such as bifid mandibular canals (BMCs) , trifid canals or additional foramen, is essential at the time of surgical procedures of mandible for prevention of potential complications. It is also reported that presence of BMCs can cause inadequate anaesthesia. Various literature studies reveal that occurrence of bifid mandibular canals are unusual but are not rare. Such anatomical variations are reported in various population based on age, gender, races, geographic distribution but there are no evidence of its occurrence reported in down syndrome patient. Down syndrome (DS) is a condition with intellectual disability and congenital heart disease and is a well-known disorder caused by an extra chromosome 21. Patients with Down syndrome face many health issues such as health issues including learning and memory, congenital heart diseases (CHD), Alzheimer's diseases (AD), leukaemia, cancers and Hirschsprung disease(HD),[8,9] DS individual have variety of physical characteristics like a small chin, slanted palpebral fissure , poor muscle tone, a flat nasal bridge, simian crease (single crease of the palm) , and oral features may include protruding tooth due to small mouth and macroglossia, gingivitis or periodontitis, microdontia, hypodontia, anterior open bite and high arched palate. Other features includes big toe, abnormal pattern of fingerprint and short fingers with clinodactyly.[10] Various radiographic assessments have been recorded in these patient for other systemic illness but only fewer literature have recorded on oral radiographic features in DS individuals. The purpose of this case report is to record one such unusual anatomical variation related to oral cavity in Down syndrome individual. Bifid mandibular canals has been proposed as one among the possible reasons for failure of mandibular anaesthesia technique for inferior alveolar nerve block and sometimes can also cause complications like traumatic neuroma, paresthesia, bleeding, hepatoma etc. Few radiographic study which assessed concomitant panoramic radiographs of patients with BMCs detected in CBCT and reported that 7.1% of BMCs were visible in panoramic views. However the studies concluded that CBCT is the reliable method for confirmation of the BMCs. But due to the cost and comparative high radiation exposure, CBCT cannot be used routinely for treatment planning for all the patients. Thus panoramic radiographs are used for routine dental radiographic assessment to assess such anatomic variations and if BMCs are suspected and not clearly visible in panoramic radiograph then CBCT maybe advised for three-dimensional evaluation and identification before any surgical procedures to avoid operative complications. In our case, based on the Nortje classification, it was found to be type III on left side (the least common type) and type I on right side. Based on Langlais classification, it was type III which is a combination of type I and type II. Based on classification, it was type B2 on left side and type A on left side. The patient was advised to take CBCT but was not affordable. Hence patient and her guardian was given adequate awareness about the condition and referred for further management to the respective department with a consent to take CBCT if required.

5. CONCLUSION

To conclude, Bifid mandibular canal is an unusual accidental radiographic finding that can often go un-recognised by general dental practitioners. The clinical relevance of this article is to remind the clinicians about the anatomy of the variation of the mandibular canal, its complications and the required assessment. This case report serves as the first evidence of the incidence of bifid mandibular canal in a Down syndrome individual and also highlights the incidence of the least common type of Bifid Mandibular Canal (Type III of Nortje classification).

6. CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-14

Florid Cementosseous Dysplasia – A Case Report

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Abstract: Florid Cemento-Osseous Dysplasia (FCOD) is a relatively rare fibro osseous lesion with multi-quadrant involvement. One such case of Florid Cemento-Osseous Dysplasia (FCOD) in a 51-year-old Indian male patient is presented in this case report. The patient presented with vague pain in the region of the left mandibular molars. Mild tenderness on percussion of the left mandibular posterior teeth were present. Panoramic radiograph (OPG) and Cone Beam Computed Tomography (CBCT) revealed multiple sclerotic masses in the periapical regions of mandibular and maxillary posterior teeth with loss of lamina dura. Histopathologically the loose connective tissue showed cementoid matrix with few empty lacunae suggestive of Florid Cement-osseous dysplasia. Biochemical analysis of serum alkaline phosphatase, calcium and phosphorus were within normal limits. Periodontal workup and conservative management of the attrited teeth were done. Patient was adviced to report for periodic review.

Keywords: Multiple periapical sclerosis, sclerotic cemental masses, Florid cemento osseous dysplasia.

1. INTRODUCTION

The term Florid Cemento-Osseous Dysplasia (FCOD) refers to a group of fibro-osseous (cemental) exuberant lesions with multi-quadrant involvement[1]. FCOD was first described by Melrose et al. in 1976[2]. It is a very unusual condition presenting in the jaws, previously known as gigantiform cementoma, multiple cementoossifying fibroma, sclerosing osteitis, multiple enostosis, and sclerotic cemental masses of the jaws. Florid cemento-osseous dysplasia is a benign, fibroosseous, and multifocal dysplastic lesion of the jaw that consists of cellular fibrous connective tissue with bone and cementum-like tissue[3]. These lesions are ordinarily witnessed in middle-aged black women, although it also may occur in Caucasians and Asians. The reason behind this predilection still remains unexplored. Current classification of cementomatous lesions published in 2005 by the World Health Organization (WHO) is based on age, sex, clinical characteristics, location of the lesion, histopathologic and radiographic features. This classification includes cemento-ossifying fibroma, benign cementoblastoma and cemento-osseous dysplasia (COD) groups[4]. Cemento-osseous dysplasia encompasses periapical cemento-osseous dysplasia, focal cemento-osseous dysplasia and florid cemento-osseous dysplasia. It has been implied that the origin and pathogenesis of these lesions is from periodontal ligament since they are seen in close proximity to the periodontal ligament. Similarly, few authors have reported that the remains of cementum in bone after extraction might be a reason for FCOD. However, the explicit etiology of FCOD is still unknown[5]. Clinically, FCOD may be asymptomatic, and the lesion is incidentally encountered during routine radiographic examination. In some cases, there will be dull pain due to infection, exposure of the lesion in oral cavity, focal expansion and facial deformities. Histopathologically, FCOD shows irregular shaped, dense, cell-free cemental masses and non-lamellar bone masses in fibroblastic connective tissue[6]. Radiographically, characterized by multiple masses of mixed radiopaque structures with a circumferential radiolucency, primarily surrounding the root apices of vital teeth. However, these lesions become increasingly radiopaque as maturation progresses. These lesions are most commonly seen symmetrically in mandibular premolar-molar regions, also seen in maxilla and are often circumscribed within the alveolar bone. Cone Beam Computed Tomography (CBCT) plays an important role in the appraisal of these lesions. A case of a patient who was diagnosed with FCOD based on clinical, radiographic, biochemical and histopathology results is presented.

2. CASE REPORT

A 51-year-old male patient (Fig 1) came to Department of Oral Medicine and Radiology with complaints of chronic pain in the left mandibular molar region. The patient was undermedication for Diabetes for the past 5 years. Physical examination showed no significant abnormality. Intraoral examination (Fig 2) revealed generalised attrition. Mild tenderness on percussion was noticed in left mandibular molars. Root stumps were noted in 28. Partially edentulous maxillary and mandibular arch was noted in relation to 15, 26, 27,28. 31 and 45. The overlying gingiva and alveolar mucosa in maxilla and mandible were normal. In the panoramic radiograph (Fig 3), multiple sclerotic masses were found involving the periapical region of maxillary and mandibular posterior teeth. The lesions were symmetrical. Cone Beam Computed Tomography (CBCT) was taken for further detailed appraisal. The 3D reconstructed images (Fig 4), Sagittal sections (Fig 5), in CBCT showed multiple periapical lesions in maxilla and mandible with well-defined margins, roughly circular in shape with loss of lamina dura. Radio-opaque internal structure was noted in relation to 14, 24, 25, 28, 38, 37,36, 35, 34, 44, 46, 47 and 48. Mixed internal structure was noted in 16, 17 and 43. Radiolucent internal structure was noted in relation to 13, 12, 11, 21, 33, 32 and 41. Biochemical analysis of serum alkaline phosphatase, calcium and phosphorus were within normal limits. Correlating the clinical, radiological and biochemical profile a differential diagnosis of Periapical cemental dysplasia, Florid osseous dysplasia, Chronic diffuse sclerosing osteomyelitis were considered. Biopsy was done in the periapical region of 36. Histopathologically the loose connective tissue showed cementoid matrix with few empty lacunae suggestive of Florid Cement-osseous dysplasia.

FIG-1 Profile picture of the patient

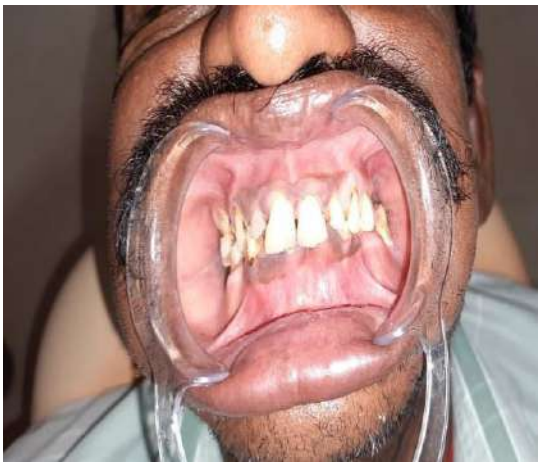

FIG 2- Intraoral image

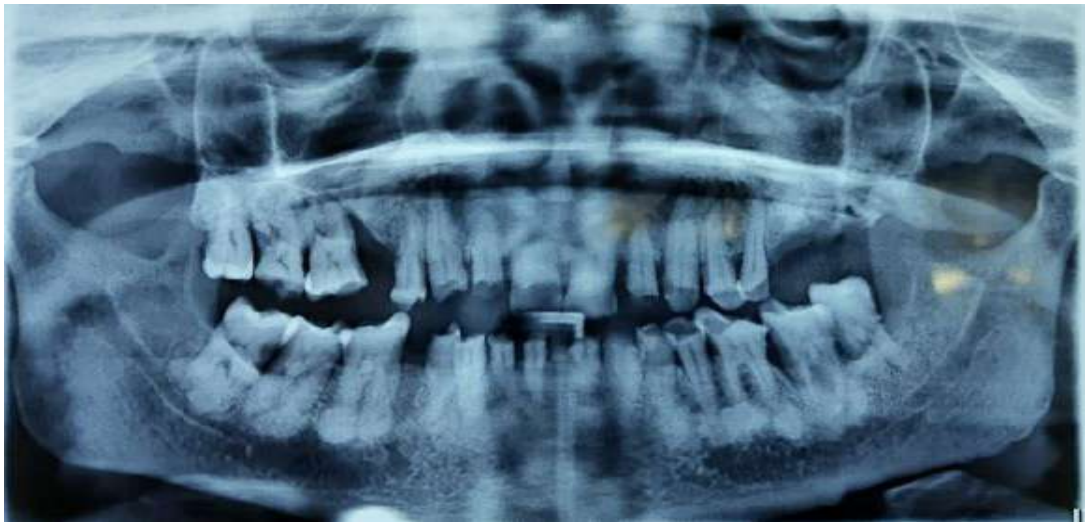

FIG-3 Orthopantomogram

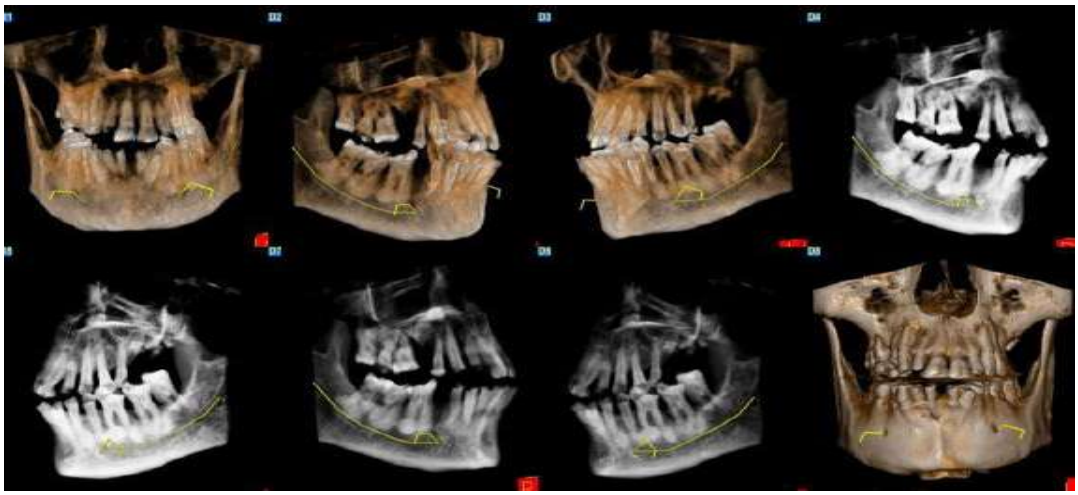

FIG-4 3D Reconstructed image

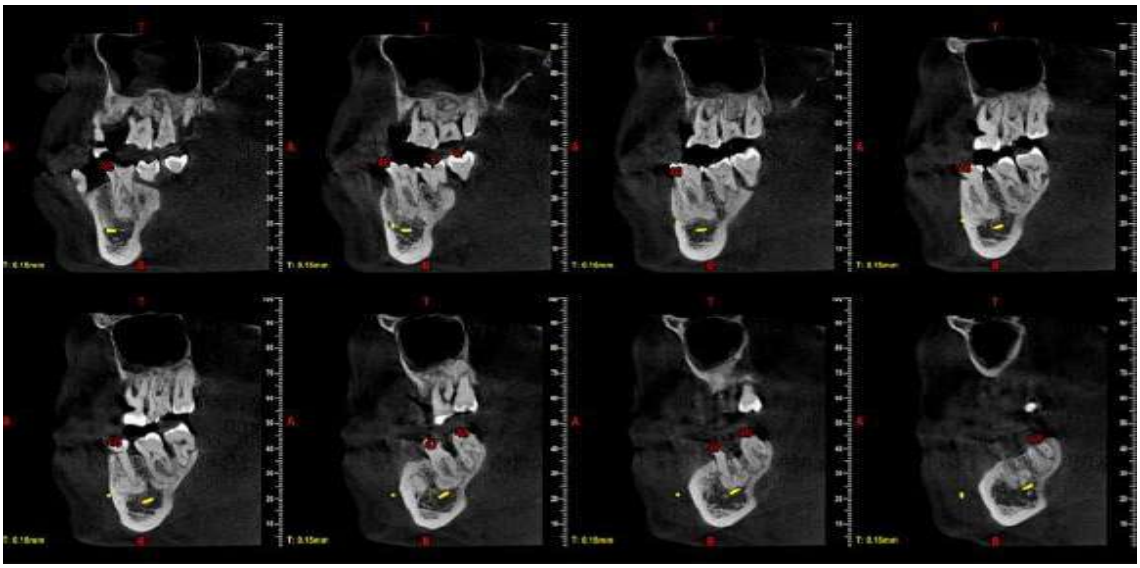

FIG-5- Sagittal CBCT images of right mandibular molar region

3. DISCUSSION

FCOD refers to a set of radiolucent-radiopaque periapical and interradicular lesions involving the mandible bilaterally and sometimes involving the maxilla. It is basically an extended form of periapical cemento-osseous dysplasia, wherein if POD is identified in three or four quadrants or is extensive throughout one jaw, it is usually considered to be FOD. These lesions are customarily asymptomatic dysmorphic bone-cementum complexes. Radiographs reveal radiolucent, mixed, or dense radiopaque masses, limited to the periapical region of the teeth. The present case was diagnosed as FCOD, involving all four quadrants. In 2005, the WHO classified the bone-related lesions, "COD" as one of the groups of this classification, and FCOD as one of the subgroups of COD which is a non-neoplastic fibro-osseous lesion[1]. Focal COD and periapical COD are the other COD lesions. However, the discernment of these lesions is based on clinical characteristics, location and radiographic features. The differential diagnosis to be considered are Periapical cemental dysplasia, Paget's disease, Chronic diffuse osteomyelitis and Cemento-ossifying fibroma. Periapical cemental dysplasia is often seen at apices of anterior teeth and usually does not exceed a limit of 1 cm. Focal cemento-osseous dysplasia is often seen at two or more mandibular anterior teeth or at the apices of molar region, and does not grow more than 2 cm whereas Florid Cement osseous Dysplasia appears bilaterally, and mostly in the mandible and often presents symmetrically. Radiolucent band surrounding the radiopaque lesion can be seen or the lesion can be wholly radiopaque[7]. Paget's disease of bone may mimic FCOD on radiological evaluation the difference is that FCOD is seen above the inferior alveolar canal, whereas Paget's involves the entire mandible and exhibits generalised loss of lamina dura in addition to various other clinical manifestations. Serum alkaline phosphatase levels will be elevated in Paget's disease but in our case the serum alkaline phosphate levels were within the normal range. Chronic diffuse sclerosing osteomyelitis is a primary inflammatory condition of the mandible, with cyclic episodes of unilateral pain and swelling; which is not confined to the tooth bearing areas. They involve the body of the mandible from the alveolus to the inferior border and may extend into the ramus, and it appears as single, poorly delineated opaque segment of the mandible,

whereas FCOD is seen as multiple round or lobulated opaque masses only at tooth-bearing areas. Cemento-ossifying fibroma which is a neoplastic lesion, displays more severe buccolingual expansion than FCOD.

4. CONCLUSION

Althogh FCOD is a rare lesion knowledge regarding it's clinical and radiographic presentation would prevent future complications. Further 3D imaging such as CBCT imaging will throw more light on the radiographic appearance. Dental extractions are not indicated since it may lead to osteomyelitis. Periodic clinical, and radiological follow‐ups and maintenance of scrupulous oral hygiene is highly advisable.

5. CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-15

Antifungal Drug Resistance – Its Importance In Oral Cavity

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Abstract: In the era where antibacterial resistance and emergence of superbugs is a prime topic of concern, antifungal drug resistance is being slightly overlooked, mainly due to less incidence of fungal infections when compared to bacterial infections. But, the growing antifungal resistance in yeasts constitutes to a significant therapeutic problem, which might require the earliest attention. This review concises about the mechanisms of antifungal resistance, their role in dentistry and its future perspective.

Keywords: Resistance, candida, antifungal

1. INTRODUCTION

Fungal infections are ranked among the top 10 opportunistic infections in most of the febrile patients with an underlying disease. They are also the major cause of mortality among these patients. Only a few fungi, which are pathogenic to humans, has the potential to infect a healthy host.1 most others invade and infect only when the host's defense mechanism becomes less efficient in immune-compromised patients like patients undergoing organ transplant, hiv patients, patients under cancer chemotherapy, etc.2 after the discovery and vast usage of newer antifungal agents in 1990s, the overall mortality of patients with fungal infections have drastically reduced.3 however the evolving resistance among fungi to many antifungal drugs have created a new challenge in treating and managing such patients.

1.1 Resistance And Tolerance

A microbe is said to be clinically resistant when it does not respond to the normal therapeutic dose of a drug; Or if the microbial growth regresses only when abnormally higher doses of a drug is administered.[4] Resistance is when a pathogen is able to withstand the effects of a drug which is usually known to be harmful to it.[5] Some can be intrinsically resistant to certain antimicrobials which is PRIMARY RESISTANCE. Some others can develop resistance to a drug gradually during the course of a therapy which is SECONDARY RESISTANCE.[2] A third category of resistance is known, called CLINICAL RESISTANCE, where the organism responsible for the disease is fully susceptible to the drug under laboratory testing, but does not repond clinically[6]. On the other hand, Tolerance is the diminished response to a drug by the host, which is also a result of repeated drug usage.[5] Drug tolerance in other words is a condition that occurs when body cells gets used to a drug so much, that it no longer responds to them, requiring an alteration in the treatment regimen.[7] Drug tolerance is also exhibited by certain parasites and microorganisms, especially when they reside in the host for a longer time. Studies done in malarial parasites have demonstrated tolerance to antimalarial drugs.[8] Extensive research on Mycobacterium species have shown drug tolerance for most of the antitubercular drugs. Both invivo and invitro study models have established that majority of microbes are destroyed within the first few days of treatment. After this the rate of killing drops, leaving behind a population of drug tolerant species.[9]

1.2 Resistance And Tolerance Among Fungi

Initially multidrug resistance in fungi was demonstrated with many studies done on Sacharomyces cerevisiae, which is a non-pathogenic yeast in humans. In this fungi, mutations were seen in the PDR1 gene on chromosome VII. Pdr1p is a transcriptional regulator which was found to have major influences on the multidrug resistant phenotypes of cells thereby regulating numerous proteins to block the toxic action of drugs on this fungi. It is thus considered as a reliable determinant of multidrug resistance in this species.[10] After this, numerous studies were conducted on common fungi which were pathogenic to human such as Candida sp., Aspergillus fumigatus etc., and similar resistance mechanisms were demonstrated. Resistance is usually known to occur in chronic oropharyngeal candidiasis treated with fluconazole, since other forms of fungal infections are less frequent or acute form of disease.[6] After the HIV pandemic, oropharyngeal candidiasis was established as an important opportunistic fungal infection associated with AIDS. Also the immunodeficient and comorbid condition of the patients lead to easy and rapid development of resistance and tolerance, especially with the Azole group.[6] Fluconazole being a potent antifungal for prophylaxis and therapy in HIV patients, is being used with restriction due to this reason.[11]

1.3 Antifungal Drugs

Antifungal drugs are broadly classified into 5 groups based on their mechanism of action.[3,12]

GROUP		DRUGS	MECHANISM OF ACTION
Polyenes		Nystatin Amphoterecin B - Deoxycholate form - Liposomal AmB - AmB Lipid complex	Through hydrophobic interactions with ergosterol in the cell membrane, and forming pores. This leads to potassium efflux, eventually causing cell death.
Azoles	Imidazole	Ketoconazole miconazole clotrimazole econazole	They inhibit C14-α sterol demethylase thereby impairing the ergosterol synthesis. This leads to accumulation of sterol precursors and reduction of ergosterol which disrupts the cell membrane integrity.
	Triazole	Fluconazole Itraconazole Voriconazole Posaconazole	
Allylamines		Terbinafine Naftifine	Inhibits ergosterol synthesis by inhibiting the enzyme squalene epoxidase
Echinocandins		Caspofungin Micafungin Anidulafungin	Inhibits the synthesis of β 1,3-glucan, a fungal cell wall polysaccharide, thereby disrupting the cell wall
Others		Griseofulvin	Disrupts the mitotic spindle thereby inhibiting fungal mitosis through interaction with the polymerized spindles
		Flucytosine	Fungal cytosine permease and cytosine deaminase, respectively imports and converts this pyrimidine analogue to flurouracil, which impairs the nucleic acid synthesis and ultimately interferes with protein synthesis

1.4 Mechanisms Of Developing Antifungal Resistance:[13,14]

The fungi acquires resistance through any of the following mechanisms.

1.4.1. Mutations in the target site

Mutations can occur in the target site of the fungal pathogen leading to conformational changes of the target site which might decrease affinity towards the target or its overexpression. It is distinctly seen in resistance towards the azole group of antifungals. Mostly point mutations are seen in the gene ERG11 which encodes for the target enzyme 14- demethylase, where there is replacement of Arginine for Lysine at position 467 (R467K). Another point mutation was observed (T315A) where Threonine was replaced with Alanine at position 315.[15]

1.4.2. Target site overexpression

Sometimes there is gene amplification, increased transcription rate, or decreased degradation of the gene product occurring in ERG11. This leads to overproduction and intracellular accumulation of high concentrates of the target enzyme. Thus the normal dosage of drug is no longer effective.[16]

1.4.3. Efflux pump overexpression

There is upregulation of various efflux pump such as adenosine triphosphate binding cassette (ABC) transporters or major facilitator superfamily (MFS) pumps which reduces the accumulation of drug within the cell. There are numerous transporter proteins under these two groups which decreases the effective drug concentrations. The ABC transporters use ATP hydrolysis for drug efflux. However, the MFS transporters are transmembrane proteins, and use the electrochemical proton-motive force for the same.[17]

1.4.4. Poor drug metabolization

This mechanism is observed in 5-flucytosine which is taken in as a prodrug in its inactive form. Then it is converted to its active drug metabolite 5-fluorouridine by the enzyme cytosine deaminase. Mutations in this enzyme has been observed which leads to formation of resistance in the drug.[17]

1.4.5. Genomic plasticity:

This can result in chromosome arm duplication further leading to conformational changes and target site overexpression

ANTIFUNGAL GROUP	MECHANISM OF RESISTANCE
Polyenes	- Regulation of stress response pathways - Absence of target site
Azoles	- Target site conformational changes - Target site overexpression - Efflux pump overexpression - Genomic plasticity
Allylamines	Unknown
Echinocandins	- Regulation of stress response pathways - Target site conformational changes
Pyrimidine analogues	- Target site overexpression - Efflux pump over expression - Inadequate conversion of prodrug

1.5 Factors Influencing The Developing Resistance:[13]

Numerous factors are involved in the evolution of resistant strains of fungi. These can be broadly categorized into environmental and drug related causes.

1.5.1. *Environmental factors*

Antifungal agents are not only used in medicine but also in agriculture to prevent crops from fungal decay. Numerous studies and reports have quoted Azole resistance in environmental isolates with specific target mutations and were able to identify the same mutation in patient samples, who were not at all exposed to Azole antifungal therapy before, suggesting that the resistance have been acquired solely from these environmental isolates.[17]

The following are some of the environmental factors which are responsible for the issue

- Global dispersal of resistant strains
- Aerial spore dispersal
- Host population density and susceptibility
- Population growth and urbanization
- Movement of people

1.5.2 *Drug related factors*

The limited groups of antifungal drugs available for treatment leaves the healthcare professional with no other options for therapy, if resistance sets in. However it becomes more challenging in cases of debilitated patients and also with emerging multidrug resistant strains. The drug related factors responsible for resistance are enlisted below

- Lack of chemical diversity
- Long courses of prophylactic therapy
- Empirical treatment with the same drug
- Lacking knowledge with antifungal combinations
- Concomitant use of antibiotics along with antifungals
- Immunocompromised patients and aggressive cancer therapies

Studies have demonstrated that administration of broad spectrum antibacterials along with antifungals increases the probability of developing resistance in the fungi. Antibiotics tend to wipe out the gut flora which leads to colonization of candida in the gut and further causing dissemination into blood. Also certain antibiotics have the potential to directly induce resistance in some fungi.[18]

1.6 ROLE OF ANTIFUNGAL RESISTANCE IN DENTISTRY

The oral cavity lodges a diverse population of microorganisms including various bacteria, viruses and fungi. Though fungi contributes to a minor component to the oral microflora, it plays a significant part in causing oral diseases. Most of the fungi present in the mouth act as commensals and does not cause any harm in a healthy host. They become pathogenic under favorable conditions like immune suppression, improper oral hygiene, etc. Candida is the most common species colonizing the oral cavity and Oral candidiasis is the most common fungal disease occurring in the mouth which can be manifested in various forms.[19] Occurrence of other deep fungal infections involving the oral cavity and associated structures like Mucormycosis are also reported. Mostly polyenes and Azoles are useful in treating oral fungal infections. However, Echinocandins and other

parenteral drugs can be used for deep fungal infections with systemic involvement. Azoles are the major group which innately has less susceptibility to Candida species and their predominant mechanism of developing resistance is through overexpression of drug efflux pumps.[19] Oral fungi exhibits resistance individually as cells or when they coexist with other organisms in a biofilm. The resistance is stronger when occuring in biofilms, since the fungi communicate and interact through various chemicals and quorum sensing molecules.

1.7 ROLE IN CANDIDAL INFECTIONS

Candida albicans is the primary and a relatively common species isolated from a bloodstream candidal infection. The first gene isolated from Candida albicans, responsible for resistance was MDR1 gene which encodes for a group of proteins, which are members of major facilitator superfamily of membrane transporters. Later, two other genes encoding the homologues of these proteins were found namely CDR1 and CDR2. Lab studies have proved the over production of CDR1 and CDR2 transcripts in numerous drug resistant isolates[10]. Candida glabrata is the next most common and predominant species associated with fungemia. They can easily acquire resistance compared to C. albicans. Sacharomyces cerevisiae and Candida glabarata share similar pathways of multidrug resistance, with the gene involved being CgPDR1 encoding for the protein Cgpdr1p. Candida auris was identified in 2009. It is an emerging multidrug resistant yeast known to spread easily within hospitals. According to the CDC, it has appeared in four different strains across the globe at the same time and suspected to spread through international travel. This species is known to be resistant to all the groups of antifungal drugs making the treatment difficult[20]. Candida species are predominantly known to exhibit resistance against Azole group of drugs in multiple mechanisms.[6,19,21] Point mutations occur at the target site, causing overexpression of Erg11p gene and conformational changes in the target site. There is also overexpression of efflux pumps which prevents accumulation of the drug within the cell[19,21]. Candida cells also exhibit resistance properties when growing in a biofilm. The formation of a biofilm acts as a major challenge in treating fungal infections. Candida is known to secrete a QSM called farnesol continuously which inhibits hyphal formation at high cell concentrations and promotes dispersal of yeast cells to form new colonies.[19] There is increase in resistance towards Ketaconazole, Itraconazole, Fluconazole and Amphoterecin B. Some of the factors which facilitates and enhances resistance includes: the presence of extracellular materials that prevents antifungal penetration like carbohydrates, proteins, hexosamine and uronic acid; Presence of a subpopulation of resistant 'PERSISTER CELLS' which can remain viable even in the presence of an antimicrobial agent; Reduced synthesis of ergosterol by the fungal cells.[21]

1.8 HOW TO PREVENT OR TACKLE ANTIFUNGAL RESISTANCE – FUTURE PERSPECTIVE

Avoid dosages which are too low or very short courses of treatment. It is essential that proper treatment regimen should be followed for the treatment. Drugs should be administered at the higher end of the maximum tolerable dose. This could reduce the emergence of resistant fungi.[21] Once resistance is identified for a particular drug high doses can be administered in order to achieve the desired effect for treatment. Prudent use of antifungals are mandatory to prevent resistance. Treatment should be given appropriately only after susceptibility testing. Empirical therapy or irrational use should be avoided at the maximum. For invasive or deep fungal infections, surgery can be the first choice of treatment to reduce most of the microbial load, followed by antifungal therapy for maintainance. Limited groups of antifungal agents available for therapy is one of the reasons for developing resistance and dispersion of resistant strains. Discovery of newer generation antifungals with different targets might help to overcome this crisis.[15]. Certain studies also quote that use of herbal sources like lemon juice, lemon grass, Lawsone methyl ether extracted from Impatiens balsmina and Swertia calycina, etc are known to have potent antifungal and antimicrobial properties and can be used as an alternative for chemical therapeutics.[11] Role of probiotics in antifungal therapy has also been studied in order to tackle this situation and has proved to be successful.[11]

2. CONCLUSION

Thus antifungal resistance is an emerging crisis which should be carefully dealt with in order to minimize the evolution of more antifungal resistant strains, thereby making the treatment less challenging. Limited groups of antifungal drugs available, pose more threat, and multidrug resistance largely limit the treatment options. Antifungal resistance is of concern mainly for patients with invasive fungal infections. However, invention of newer novel antifungal agents and appropriate use of antifungals with proper protocols being followed might help to overcome this obstacle.

3. CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-16

Acute Necrotizing Ulcerative Gingivitis - A Review

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Abstract: Acute necrotizing ulcerative gingivitis (ANUG) is a non-communicable microbial gingivitis caused by a compromised host immune response. It is distinguished by the presence of "punched-out" crater-like lesions of the papillary gingiva, as well as the onset of sudden inflammation and pain.It is identified by necrosis of the gingival papillae crest, spontaneous bleeding, pain, and halitosis. If untreated, it can spread laterally and apically to involve the entire gingival complex, including the mucosa and alveolar bone, eventually leading to necrotizing ulcerative periodontitis, necrotizing ulcerative stomatitis, and Noma. Predisposing factors include poor oral hygiene, stress, smoking, hormonal imbalance, nutritional deficiencies, and so on.

Keywords: Punched out ulcer, Ulcerative gingivitis, Crater like lesions, Spontaneous bleeding

1. INTRODUCTION

Acute necrotizing ulcerative gingivitis (ANUG) is a painful type of gingivitis characterised by gingival pain, bleeding, and interproximal papillomacular necrosis. In 1896, Plaut (Barnes et al., 1973)[1] and Vincent described ANUG for the first time. Military historians have documented a condition characterised by painful, bleeding gingival tissues, necrosis, and fetor oris for centuries. This oral disease was not scientifically investigated until the work of Plaut and Vincent in the 1890s. During World War I, it was named as "trench mouth.It has several names, including Vincent's disease and trench fusospirochetal gingivitis .This type of gingivitis is uncommon. Proliferating oral anaerobic bacteria play a role in the development of the disease's clinical signs and symptoms, possibly as opportunistic pathogens. Secondary predisposing etiologic factors such as stress, impaired chemotaxis, poor oral hygiene, alcohol consumption, smoking, general debilitation, and malnutrition have all been studied.

2. ETIOLOGY

The exact cause of ANUG is unknown, but it is thought to be a polymicrobial infection caused by normal oral cavity commensals. However, when the local resistance of the human gingival area is reduced, the organisms become pathogenic.ANUG is most commonly caused by an opportunistic bacterial infection and is mostly caused by fusiform and spirochete bacteria. Spirochetes and the majority of Gram-negative bacteria, including Bacteroides intermedius and Fusobacterium spp., were identified as the most common causes in one study.[1,2]Another study identified Treponema spp., Selenomonas spp., Fusobacterium spp., and Prevotella intermedia among the microbiota associated with ANUG. [3] Eventually, ANUG is linked to spirochetes and gram-negative bacteria, which can be identified using the gram stain if performed. [4]

3. EPIDEMIOLOGY

Some centuries ago, ANUG was well known in Europe and North America. ANUG was reported in these Western countries, particularly amon personnel from the military As early as 401BC,Xenophon[5] described a clinical entity that resembledANUG in his soldiers' mouths. Bergeron[6] described a similar disease entity in 1859.Among the French troops with whom he served. a select fewcases reported in the European literature Prior to its association with AIDS, it was most commonly found among military personnel in North America.[7,8] However, because HIV infection is so common, ANUG has become widely recognised as a lesion that is strongly pathognomonic of the infection, especially when seen in otherwise healthy young adult.[9,10]The prevalence of ANUG among HIV-infected patients has been reported to range from 4.3 percent to 16.0 percent.[10-12]. In marked contrast, the disease is still frequently seen in developing countries, especially in SubSaharan Africa where it occurs almost exclusively among poor children usually between the ages sof 3 years and 10 years from low socio-economic backgrounds.[13,14,15-19]Similar findings have been reported in India. 22 In Nigeria, hospital-based studies conducted over the last decade indicate that the incidence of ANUG is increasing among children, with a prevalence of up to 23% in children under the age of ten being reported. [13,19,20] In contrast, the disease is still prevalent in developing countries, particularly in Sub-Saharan Africa.

4. PATHOPHYSIOLOGY

Psychological stress, poor diet, insufficient sleep, alcohol, tobacco, poor oral hygiene, pre-existing gingivitis, and HIV infection are all physiologic factors that contribute to ANUG. These factors have been shown to impair the host immune response, allowing bacteria to spread more easily. Psychological stress decreases gingival microcirculation and salivary flow while increasing adrenocortical secretions, both of which can alter the function of polymorphonuclear leukocytes and lymphocytes. This alters the patient's immune response as well as his or her behaviour and mood, resulting in poor oral hygiene, malnutrition, and increased tobacco consumption.[20] Similarly, a poor diet raises histamine levels and increases gingival capillary permeability, resulting in decreased PMN leukocyte chemotaxis. [20]

5. CLINICAL FEATURES

While some ANUG signs and symptoms appear to be pathognomonic for the disease, others appear infrequently. Perhaps the most widely used Interproximal necrosis is one of the agreed-upon signs8, with ulcération, pain, and bleeding in the affected area that the "classical symptoms" of Vincent's infection were [21] spontaneous interproximal haemorrhage without gingival redness and [22] inflamed papillae apices that bleeds easily without tenderness. They went on to say that the stereotypical CLINICAL description of interproximal destruction in Vincent's infection is not an unavoidable symptom [23].Schluger [24], on the other hand, provided the most widely recognised and accepted description of the pathognomonic signs of ANUG in 1943: This finding is supported by Barnes et al.8's large study (218 cases), in which gingival bleeding and interdental blunting or cratering were found to be the most commonly associated signs. Suzuki et al.[25]recently reported that all 35 patients they examined had interproximal cratering of the gingival papillae, 97 percent had foetid odour, 85 percent had pseudomembranous formation, and 76 percent complained of bleeding gums.

6. MANAGEMENT

Initially, treatment options for ANUG were nearly as numerous and diverse as its synonyms, but they all focused on reducing the bacterial flora. Vincent,In 1898, he described a treatment that included local iodine application and gargles with boric acid solution.consisting of potassium permanganate solution rinses, iodine tincture locally applied, and hydrogen peroxidePeroxide rinses and thorough mechanical debridement are both recommended.followed by the application of silver nitrate to the periodontal ligament sulci. Hirschfeld proposed treating gingival inflammation with frequent sodium peroborate rinses, thorough debridement, and no toothbrushing until gingival inflammation was reduced the following year. [23]Schluger[26]describes a streamlined treatment that consists of thorough, deep curettage followed by frequent rinses of diluted hydrogen peroxide or even plain water, primarily as a lavage.Fitch and colleagues report that immediate ultrasonic instrument debridement was highly effective in the treatment of ANUG, with rapid symptom relief and "remarkable tissue response." Goldhaber and Giddon12 agree with this approach to therapy, but they also advocate for the use of antibiotics, specifically penicillin, in the treatment of advanced cases. Gingivoplasty is thought to be important in preventing disease recurrence by removing the residual soft tissue craters.[27,26]. Recent English dental literature supports the use of antibiotics in the treatment of ANUG, and researchers found metronidazole to be as effective as penicillin in causing remission of ANUG clinical symptoms in double-blind clinical studies. This is consistent with the findings of Loesche and colleagues, who reported that metronidazole treatment resulted in the immediate resolution of clinical symptoms. Clinical status improved in tandem with a decrease in the proportions of bacterial species associated with the disease.[28,29]

7. CONCLUSION

Over the years, there have been almost as many different ways to treat ANUG as there have been synonyms, but they all revolve around reducing the bacteria flora. The usage of the use of antibiotics in the treatment of ANUG has increased. It has been strongly urged. Metrondazole is a drug that is used to treat. It's also been discovered that it's just as effective as penicillin in treating infections.resulting in clinical symptom remission, and this occurred in tandem with a decline in overall of women in the workforce. The highly preventable ANUG, on the other hand, entails putting in place measures to combat malnutrition, improve oral hygiene, and improve overall health.minimising oral mucosa damage as well as keeping the oral environment free of contamination Bacteroidacease, particularly F. necrophorum, has a heavy load. Ulcerations of the oral mucosa and Traumatic lesions, such as traumatic tooth eruption, should be considered as having the potential to develop into ANUG. Furthermore, the prevention of water contamination due to faeces and weaning foods Another way to avoid this is to improve your nutritional status and practise good oral hygiene. This is a disease that is highly preventable.a list of bacteria species linked to the disease.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-17

Necessity Of Biopsy In Clinical Practise

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Abstract: In our general clinical practise, patients usually present with oral lesions. Hence it is most important that every dentistshould have a knowledge about the intraoral pathology and also dentist should know how to deal with pathology when it occurs and also with the investigative techniques that might assist in diagnosis making. Biopsy and histological examination of the lesion is an important diagnostic tool. Biopsies provides evaluative control of disease progression and are able to record healing or relapse. A biopsy is usually the only way to give a confirmatory diagnosis of oral lesions and diseases. All dental care professionals should know how to perform simple oral biopsies for diagnosing oral lesions. The capability of distinguishing benign and premalignant or malignant oral lesions is necessary for establishing a perfect diagnosis. This review article discussesthe applications, indications, contraindications of biopsy, criteria for selection of biopsy site and types of biopsies.

Keywords: Oral biopsy, Histopathological examination, Malignancy

1. INTRODUCTION

In dental practise, patients usually present with intraoral lesion. Therefore, it is important that every dental practitioner must be aware of how to deal with pathology when this occurs and they should also have a knowledge of investigative techniques which may assist in making a diagnosis. Usually in many instances, microscopic or histopathological examination of tissue is the gold standard for the diagnosing oral lesions and the tissue surrounding it.[1,2] The word biopsy is a Greek terms bios (life) and opsis (vision), hence the term means vision of life. A biopsy follows a procedure of obtaining a tissue from a living organism with the rationale of examining it under the microscope for establishing a diagnosis based on the sample.[3] An accurate histopathologic diagnosis depends mainly on the dentist doing biopsy at an appropriate site and issuing an adequate clinical information, and on the pathologist correctly interpreting the biopsy results.[4]

2. APPLICATIONS OF BIOPSY

For diagnostic, prognostic and treatment planning purposes biopsy is used. Furthermore, it can be used for checking the extent of the disease and also for predicting the end results.[5,6]

3. INDICATIONS OF BIOPSY

Biopsy is usually indicated for the following

3.1 Any longstanding growth present for more than 3 weeks;
3.2 Any progressive ulcerated lesion which has been present for 3 weeks or one which fails to respond to therapy in 3 weeks;
3.3 White or red patches in mucous membrane specifically those having a warty or corrugated appearance;
3.4 Any inflammatory lesion that has no response to local treatment after 10 to 14 days;
3.5 Characteristics that increase the malignant suspicion in an existing lesion.[5,6]

4. CONTRAINDICATIONS OF BIOPSY

Biopsy is contraindicated in patients with systemic disorder which might worsen or might develop secondary complications in seriously ill patients. Furthermore, a biopsy must be avoided in the suspected case of vascular lesions including haemangioma because of the massive and persistent bleeding risk.[5,7]

5. CRITERIA FOR SELECTION OF BIOPSY SITE

Careful selection of biopsy site is necessary for accurate results. A suspicious large oral lesion, often differs in severity of disease from one part of the lesion to another part. An appropriate biopsy includes tissue from the worst part of the lesion. The worst part of the lesion may be determined by its clinical appearance, multiple biopsies and use of adjunct visual tools.[4] If dentists are not sure about the most appropriate biopsy site, the patient must be referred to either oral surgeon or oral pathologists. This is because a biopsy from an inappropriate site provides both the patient and the dentist a false sense of security.[4]

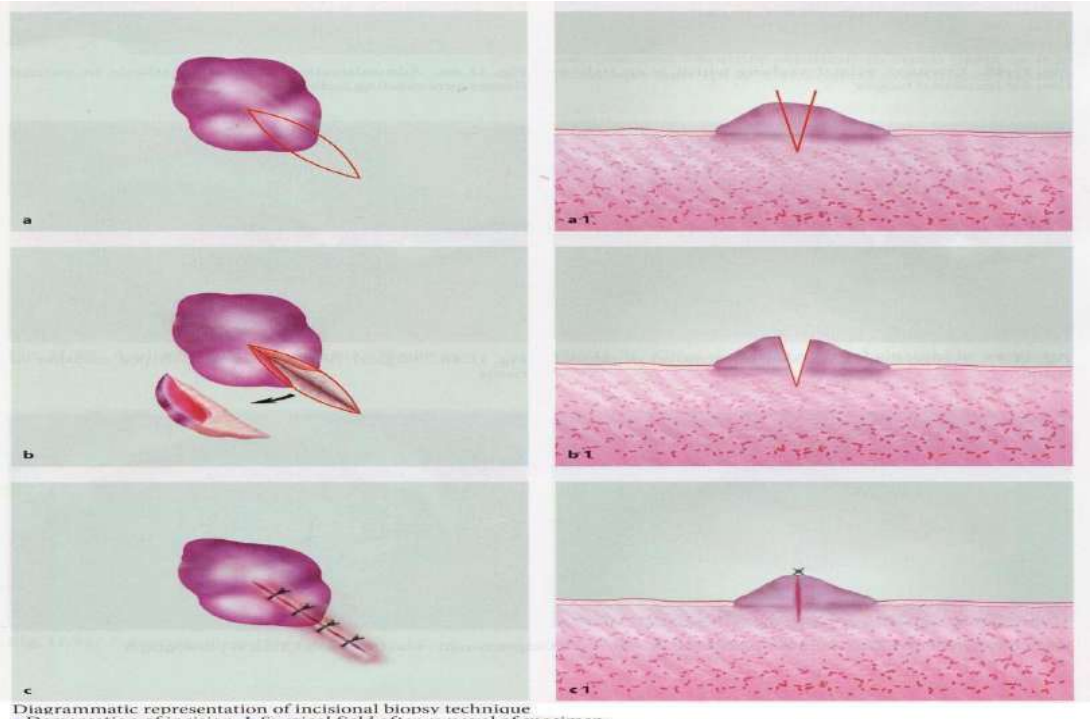
6. TYPES OF BIOPSIES

For most of the lesions, surgical biopsy is the primary choice to achieve an adequate tissue for histological examination. Other sampling technique for tissue includes cytology or fine needle biopsy, might have clinical applications. However, problem with these techniques must be understood so that information produced from these techniques can be meaningfully interpreted.[8]

SURGICAL BIOPSY

6.1 Incisional biopsy

Incisional biopsies include either the whole lesion (excisional) or part of a lesion, or part of the affected mucosa with the adjacent normal mucosa (to exhibit the interface between normal and abnormal mucosa) and removed for diagnostic purpose. Incisional biopsy is hence recognized as the gold standard.[5,9]



Diagrammatic representation of incisional biopsy technique
a Demarcation of incision. b Surgical field after removal of specimen.
c Operation site after suturing. a_1, b_1, c_1 Steps correspond to a, b, c, in vertical cross-sectional view

FIG 1: INCISIONAL BIOPSY

6.2 Excisional biopsy

The excisional biopsy is analogous to incisional biopsy, with an exception of entire lesion or tumour is included.[5]

6.3 Fine needle aspiration biopsy

FNA biopsy is performed with a fine needle attached to a syringe. Aspiration biopsy is often known as Fine Needle Aspiration (FNA). FNA biopsy is a percutaneous type of biopsy. FNA biopsy is typically accomplished with a fine 22or 25 gauge needle.[5]

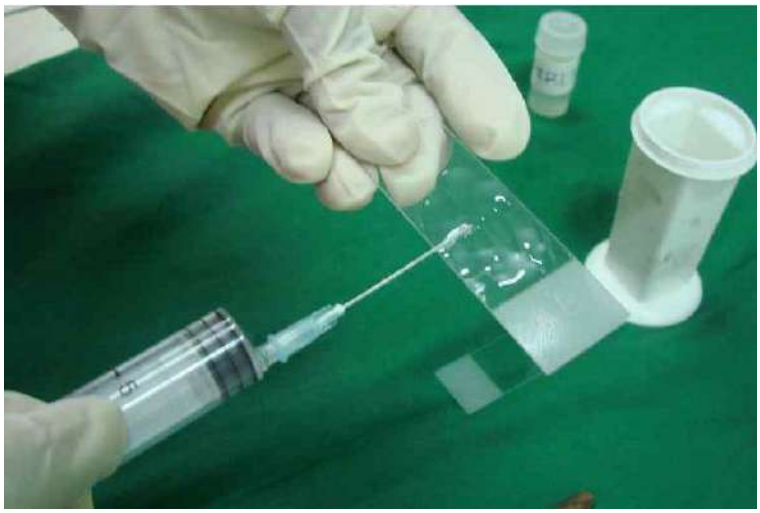


FIG 2: FINE NEEDLE ASPIRATION BIOPSY

6.4 Punch biopsy

Usually dermatologist uses Punch biopsy to sample skin rashes, moles and other small masses. By following the same procedure, punch biopsy can also be used for oral biopsy. For diagnostic purposes, it is used in an incisional fashion; however, larger punches can be used for excision of small lesions.[4,5]

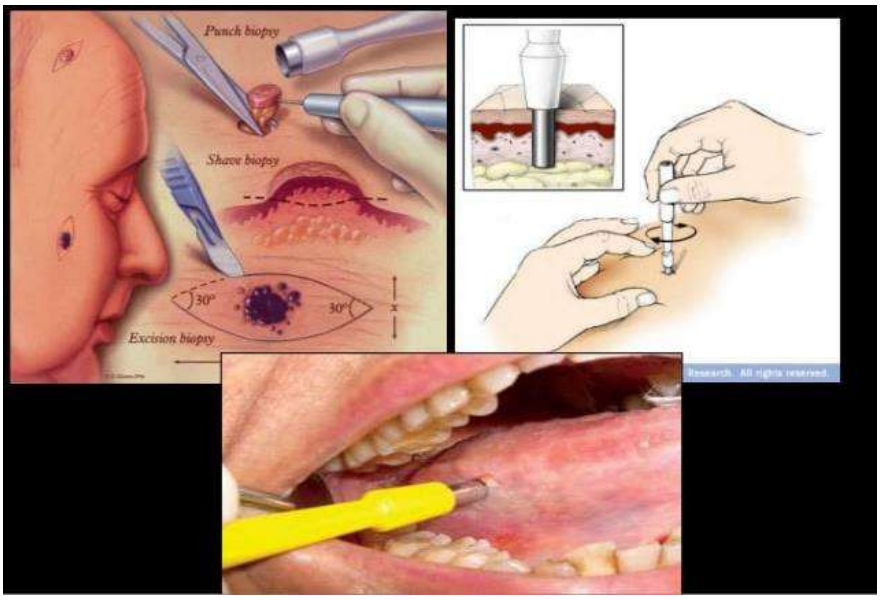


FIG 3: PUNCH BIOPSY

6.5 Exfoliative cytology/brush biopsies

This is a non-invasive method that, in certain situations, might be useful in the detection of mucosal lesion, especially in detecting superficial cellular features of lesions for atypical features which might indicate malignancy. This type of investigation can make the patient to decline a surgical biopsy.[10,11]

FIG 4: BRUSH BIOPSY

7. CONCLUSION

Many authors suggest that general dental practitioners should have adequate training to undertake simple biopsy procedures of clinically benign lesions.[12]Hence dentists should be conscious about the occurrence of lesion in their patients and even if they are not undertaking investigative techniques by themselves, they should have a knowledge about the principles of investigative techniques in relation to oral pathology and have strategies in place so that diagnoses can be made quickly .[8] Diagnosis and risk assessment of oral premalignant or malignant lesions requires both clinician and pathologists effort.[5]

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-18

Crohn's Disease And Its Oral Manifestations

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Abstract: Crohn's disease (CD) is a granulomatous inflammatory bowel disorder that was first reported in 1932 as a chronic granulomatous disease of the terminal ileum. It is currently recognized as a separate inflammatory bowel disease. It can affect any area of the gastrointestinal tract. Many patients, especially children appear with non-intestinal symptoms first, including mouth lesions. In children, oral symptoms of crohn's disease occur in roughly 50-80% of cases, and about 30% of CD cases in children begin in the mouth. The disease is marked by flares and remissions, which are driven by a complicated pathophysiology in which inflammation plays a crucial role. Crohn's disease could be caused by a complex interaction of genetic predisposition, environmental variables, and altered gut microbiota, resulting in dysregulated innate and adaptive immune responses. Oral Crohn's disease with or without intestinal signs, has been documented regularly in the previous three decades. It is recognized as one of the orofacial granulomatosis in the latter condition. There has been great debate about whether Crohn's disease intestinal signs may eventually appear in orofacial granulomatosis. Recognizing such oral lesions in children and seeking a biopsy may help to accelerate the diagnosis of CD.

Keywords: Crohn's Disease, Chronic granulomatous disease, orofacial granulomatosis, inflammatory bowel disease.

INTRODUCTION

Inflammatory bowel disease which include ulcerative colitis (UC) and Crohn's disease (CD) are characterized by persistent inflammation of the gastrointestinal tract in genetically prone people who are exposed to environmental risk factors[1]. Crohn's disease is a relapsing/remitting systemic inflammatory disease that mostly affects the intestines. Patients with Crohn's disease often have abdominal pain, fever, and bowel disturbances. Dalziel first defined the illness in 1913 as "transmural inflammation of both or either of the small and large intestines," and it was later reported as "regional or terminal ileitis" affecting mostly the ileum. Crohn's disease is the name given to this latter disorder, which can affect any region of the alimentary canal. The entire intestine is impacted by Crohn's disease inflammation, with the distal ileum being the most commonly affected region. During the course of their condition, patients with Crohn's disease go through flares and remissions. Current therapeutic options aim for profound and long-term remission in order to avoid complications and slow the progression of the disease[2].

PATHOGENESIS

The pathophysiology of Crohn's disease is based on tissue inflammation generated by an uncontrollable immunological response to luminal bacterial antigens. Immune cells such as CD4 T-Cells, CD8 T-Cells, B-Cells, CD14 monocytes, and natural killer cells invade the gut of crohn's disease patients and play a role in this process. Some intrinsic mechanisms of defense against infectious illnesses, including intestinal mucus secretion, have a role in immune-mediated susceptibility to Crohn's disease[3, 11]. Pathogenesis is caused by interactions between environmental stimuli, immune system, susceptibility genes, and changes in the micro biome of the host, resulting in intestinal mucosa disturbance [3]. Crohn's disease is characterized by excessive IL-12/IL-23 and IFN-/IL-17 production in the small intestine and colon, as well as discontinuous ulceration and full-thickness intestinal wall inflammation with granulomas[2, 4]. Gene mutations have been related to Crohn's disease with CARD15/NOD2 having the strongest connection. THE CARD15/Crohn's disease starts in the sub mucosa of the intestine and spreads over the intestinal wall, affecting the mucosa and serosa [2, 4]. Type 1 T helper -cells initiate a harmful inflammatory response and activate leucocytes, resulting in further damage. Leucocytes release prostaglandins, proteases, reactive oxygen species, leucotrienes, and nitric oxide, which perpetuate the inflammatory response and consequent damage. After neutrophils infiltrate and destroy the intestinal crypts, aphthoid lesions (shallow ulcers) develop[6]. Skip lesions are created when inflammation and lesions are interspersed with healthy mucosal tissue. The tissue on one side of the intestinal wall may be injured, whereas the tissue on the other side may be intact. Longitudinal and transverse fissures and crevices frequently extend into lymphoid tissue and are surrounded by edema in the sub mucosa, resulting in granuloma and a cobblestone appearance of the infected bowel (smith & haris 2014). Inflammation, edema, and fibrotic strictures can cause the intestinal lumen to constrict [3]. NOD2 genes code for a protein that aids in the identification of gram negative and gram positive bacteria. Crohn's disease could be the result of an overactive reaction to normal flora in the gut of individuals with a genetic predisposition[2,10].

CLINICAL MANIFESTATIONS

Patients report abdominal discomfort, diarrhea (greater than 5 stools per day), and rectal bleeding as well as weight loss, and exhaustion as gastrointestinal and systemic symptoms. These deficiencies may lead to anemia, hypoalbuminemia, and bone disease from low folic acid, vitamin –B12, vitamin-D and calcium levels. Patient may also experience extra intestinal manifestations including fever, gall stones, mouth ulcers ,erythema nodosum,primary sclerosing cholangitis of the liver,uveitis of the eye and migratory polyarthritis.30% of individuals experience fissures ,fistulas and /or perianal abscess(screenshot).there is an increased risk of intestinal adenocarcinoma for patients with a long duration of Crohn's disease[10]. Current therapeutic options aim for profound and long-term remission in order to avoid complications and slow the progression of the disease[2].

ORAL MANIFESTATIONS

The number of young individuals with oral signs of inflammatory bowel disease may be expanding as the frequency of the disease rises Any region of the oral cavity, including the buccal mucosa, lips, tongue, hard and soft palate, salivary glands, gingiva, and teeth, can be affected by oral crohn's disease. Alterations can be pathognomonic (occurring almost usually in association with inflammatory bowel disease), highly suspicious (occurring almost always in association with inflammatory bowel disease), or nonspecific Orofacial granulomatous cheilitis, and pyostomatitis vegetans are examples of pathognomonic oral changes. Up to 5-15 % of CD patients develop orofacial CD, which includes recurring or persistent lip swelling, cobblestone apperance of the oral mucosa, stomatitis, mucogingivitis, deep linear or serpiginous ulcerations surrounded by epithelial hyperplasia, tissue tags, or polyps, and is often linked to Candida-associated angular cheilitis[8]. This modification resembles the features present in the gastrointestinal tract macroscopically and histologically and can be related with pain on touching or while eating acidic or spicy meals, impairment of oral function, eating, speaking, and psychosocial stress[6,8]. Orofacial Crohn's disease on the other hand is indistinguishable from orofacial granulomatosis, a clinical condition seen in a variety of disorders such as sarcoidosis, Miescher's cheilitis granulomatosa, Melkersson-Rosenthal syndrome, foreign body granuloma, and many granulomatous infectious diseases[2,8].Crohn's disease can develop in up to 40-50 percent of young children with orofacial granulomatosis, and it can appear years after the first oral symptoms. Granulomatous cheilitis is a rare, subacute granulomatous disease that affects only the lips. A history of abrupt swelling of the lips, primarily the lower lip, that subsides within hours or days, followed by permanent edema and lumpy swelling is commonly observed. However, allergies, sarcoidosis, Melkersson-Rosenthal syndrome, relapsing herpes simplex, relapsing erysipelas, malignancies, and genetic illnesses can all manifest as granulomatous cheilitis[7, 8] Finally, pyostomatitis vegetans is an uncommon manifestation that has been related to inflammatory bowel illness. It's characterized by a swollen and erythematous oral mucosa with pustules and superficial erosions that seem like "snail tracks." In 75 % of patients, it's associated to inflammatory bowel disease[8.]

HISTOPATHOLOGY

The lesion was covered with stratified squamous parakeratinized epithelium.On histopathologic examination, which ranged from atrophic to hyper plastic areas. There were also areas of spongiosis and ulceration. The connective tissue was moderately fibro cellular and edematous, Chronic inflammatory cells primarily lymphocytes and macrophages, Hemorrhagic areas, blood vessels, and multiple non-caseating granulomas were found in a single location. They were also seen subepithelially. Each non-caseating granuloma was textured loosely and a focal mass of epithelioid cells surrounded by chronic inflammatory cells, as well as the occurrence of a foreign body type or langhans type of giant cells[2, 7.]

DIAGNOSTIC INVESTIGATIONS

Thrombocytosis elevated acute phase proteins (especially C-reactive protein), and anemia are common laboratory findings. C-reactive protein is a biomarker used to assess disease progression, but it has a weak correlation with endoscopic findings. Hypoalbuminemia and vitamin deficits are common in those with severe small intestinal illness. Antimicrobial antibodies are found in 60–70% of patients' serum, with anti-Saccharomyces cerevisiae antibody IgA being the most common[2, 10]. These antibodies sensitivity and specificity are insufficient for diagnostic purposes. Patients with high titers and high rates of positive markers, on the other hand, are more likely to develop aggressive phenotypes. Stool biomarkers, such as faecal calprotectin, are increasingly being used in inflammatory bowel disease as screening tests and to monitor disease activity. Calprotectin concentrations in the faeces correlate with neutrophil infiltrates in the gut and are a sensitive and specific surrogate biomarker of intestinal inflammation for the diagnosis of IBD. In patients with symptoms suggestive of irritable bowel syndrome, a faecal calprotectin content of less than 40 µg/g has been linked to a 1% likelihood of developing IBD. As a result, this marker could be helpful in primary care to screen individuals for colonoscopy[2,7]. Fecal calprotectin correlates strongly with endoscopic activity in individuals with established crohn's disease and is a helpful biomarker for monitoring disease activity, assessing response to medication, predicting clinical relapse, and surgical recurrence. The cutoff threshold for differentiating mucosal inflammation depends on the test and might range from 50 to 250µg/g [2]. A fecal calprotectin content of more than 100 µg/g has high sensitivity for predicting endoscopic recurrence in the postoperative condition. The gold standard diagnosis is endoscopy.Typical findings include segmental inflammation, apthoid, and longitudinal and serpiginous ulcerations. Finally, colonoscopy is useful for monitoring colorectal neoplasia and treating problems such as strictures. Ultrasonography, CT-enterography, and MR-enterography are examples of cross-sectional imaging studies that have become increasingly important in the management of Crohn's disease. At the time of diagnosis a CT or MR-enterography should be performed to determine the degree of the disease and the existence of complications such as strictures or fistulas, as well as to provide information regarding disease behavior. For proper assessment and delineation of fistulous pathways, pelvic MRI should be used to evaluate perianal fistulas or abscesses or both[1,2].

TREATMENT

Crohn's disease is treated using an induction and maintenance regimen. Corticosteroids, nutritional therapy, immunosuppressants (thiopurines [azathioprine and mercaptopurine] and methotrexate), biologicals (anti-TNF [infliximab, adalimumab, and certolizumab pegol], and anti-adhesion molecules) are the most often used medications in Crohn's disease (vedolizumab). 5-aminosalicylates are ineffective in preventing crohn's disease recurrence after surgery and have a low efficacy in the preoperative environment. Antibiotics should be restricted to Crohn's disease patients who have fistulas or abscesses, or both[2]. Assessing for and controlling intestinal disease is the first step in treating oral diseases. It's also crucial to construct a comprehensive differential diagnosis for oral manifestations, which includes pharmacological side effects, nutritional deficits, infections, and other granulomatous disorders with oral signs. If the oral findings are asymptomatic, no therapy is required, and the lesions will disappear over time in combination with the treatment of gastrointestinal disease. A combination of clinical, biochemical, radiographic, and endoscopic findings is used to make the diagnosis of CD[6, 8]. Symptomatic relief is provided by beclamethasone mouthwashes (0.5 mg diluted in water, up to 6 times a day). However, there is a significant risk of systemic steroid absorption and associated side effects, which makes this kind of treatment unsuitable for long-term use. Topical tocrolimus can aid with lip edema in rare cases. It has been reported that a steroid was injected intralesionally into swollen lips. This type of treatment, on the other hand, appears to provide just a short-term advantage and can be uncomfortable. Immunosuppressant can be considered early in the treatment of individuals suffering persistent discomfort, edema, and cosmetic deformity[6, 7].

CONCLUSION

Interactions of genetic, immunologic, microbiological, and environmental variables result in chronic intestinal inflammation. I believe Inflammatory bowel disease(IBD) is caused by a failure to adequately down regulate nonspecific inflammation caused by an environmental trigger, such as an acute, self-limited infection or the use of nonsteroidal anti-inflammatory drugs (NSAIDs).Infections are cleared very quickly in normal hosts.Downregulation of innate immunity by invasive enteric bacteria immunological responses and the healing of the mucosa that has been harmed without any sort of stimulation or reactions of T-cells. Genetically susceptible hosts, on the other hand, who are unable to clear an invading pathogen and/or generate tolerogenic immune responses to commensal pathogenic microbes- by mounting appropriate innate immunity, down regulating immune responses, or healing the mucosal barrier—activate pathogenic T-cell responses to commensal bacteria and develop chronic, relapsing intestinal inflammation. T-cell apoptosis resistance, a lack of sensitivity to down regulatory signals, and ongoing exposure to luminal antigens and adjuvant all contribute to the persistence of this inflammatory response. Diet, smoking, stress, a changed microenvironment, and NSAID exposure are all factors that can affect mucosal immune responses and enteric bacteria composition. Although I believe that self-limited, non-specific infections can trigger chronic inflammation and reactivate latent disease, it is possible that a persistent pathogen could cause disease in people who are unable to clear infections (e.g., those with certain CARD15 polymorphisms), or that the commensal bacteria of some patients could acquire virulence factors (e.g., toxins, adherence, and/or invasion properties) that cause chronic intestinal inflammation. It's a rare occurrence for dentists and other clinicians to diagnose the condition based on oral clinical signs. Oral mucocutaneous and granulomatous lesions should alert the clinician to look into the gastrointestinal tract. Early Crohn's disease diagnosis would result in better patient management and prognosis.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-19

Drug Induced Gingival Enlargement-A Review

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Abstract: Enlargement of gingiva can occur by taking any medications which leads to problems of speech,mastication and aesthetics. Drug induced gingival enlargement manifests as abnormal growth of gingiva due to adverse drug reactions. The key drugs are anti convulsants, immunosuppressants and calcium channel blockers. It commonly affects the oral hygiene and interfere with masticatory functions. This article relates the various gingival enlargement caused by drugs and its pathogenesis and clinical manifestations.

Keywords: Gingival enlargement, drug induced gingival enlargement, drugs, anticonvulsants, calcium channel blockers, phenytoin, pathogenesis.

1. INTRODUCTION

Drugs are the most common cause of gingival hyperplasia. Drug induced gingival enlargement also known as drug induced gingival hyperplasia is a side effect of certain drug and the overgrowth cannot be explained[1]. It is seen in patients having drugs such as anticonvulsants, immunosuppressants, calcium channel blockers.

2. DRUGS CAUSING GINGIVAL OVERGROWTH[1-5]:

Anticonvulsants: Phenytoin, Sodium Valproate, Phenobarbitone, Vigabatrin, Primidone, Mephenytoin, Ethotoin, Ethosuximide, Methosuximide,

Immunosupressants: Cyclosporin, Tacrolimus, Sirolimus,

Calcium Channel Blockers: Nifedipine, Nitrendipine, Felodipine, Nicardipine, Manidipine, Amlodipine, Nimodipine, Nisoldipine, Verapamil, Diltiazem.

3. ANTICONVULSANTS

These drugs cause overgrowth of gingival tissue. Phenytoin is the drug of choice for the treatment of grand mal etc and is the most common drug that induce gingival enlargement[6]. Phenytoin was introduced in 1938 as an antiepileptic drug. Literature suggest that these drugs cause gingival growth in fetus as well as congenitally[7].

3.1 Clinical Changes

The gingival growth appears 2-3months of drug use and increases after 12-18months[8]. It is more common in young people. The phenytoin can cause megaloblastic anemia[9].

3.2 Histopathologial Feature

Proliferation of fibroblasts is seen but fibroblast to collagen ratio is similar[9].

3.3 Pathogenesis

Molecular-cellular studies showed the increased expression of TGFB in lamina propria. Increased PDGF-BB as a mitogenic factor and chemotaxis of gingival fibroblasts as well as the increasedIL1B and IL6 resulting in the increased synthesis of collagen and glycosoaminoglycans were reported. Phenytoin-induced reduction of folic acid leads to degenerative changes in the epithelium exacerbated in the presence of inflammatory factors. The increased synthesis of testosterone metabolite by fibroblasts can cause gingival enlargement in people who take phenytoin [8-10].

3.4 Treatment

After stopping the drug, the enlargement disappears spontaneously in 4months. Then periodontal therapy is advised and follow up is recommended first six months and then once in 3 months. Topical folic acid has shown little improvement since it gives fibroblasts with higher concentration of folate[8,9].

4. IMMUNOSUPPRESSANTS

Cyclosporin is the most commonly used immunosuppressants . They are given after organ transplantation like renal transplants and in treatment of rheumatoid arthritis.Tacrolimusor FK506 is less toxic than cyclosporine[6,11,12]. Cyclosporine have side effects such as nephrotoxicity, hepatotoxicity, hypertension, and gingival overgrowth[13]. Synergistic effects have been reported when cyclosporin is administered concurrently with calcium channel blockers of dihydropyridine derivatives[14].

4.1 Clinical Appearance

It is associated with hyphal candida having pebbly or papillary appearance invading the gingival epithelium and the people taking immunosuppressants are more hyperemic and prone to bleeding on probing[15]. It is predilected in both men and women[9]. Occurrence of Age is between 20-40years of age.

4.2 Histopathology

It is often seen in connective tissue wand secularization as well as focal inflammatory cells particularly plasma cells. It is due to epithelial acanthosis and accumulation of extracellular matrix[16].

4.3 Pathogenesis

Blood and cellular immunity response has been influenced by selective and reversible inhibition of T helper cells[17]. Secretions of the enlarged gingiva contain more IL6 compared to normal gingiva. IL6 increases the proliferation of fibroblasts and synthesis of glycosoaminoglycans[9].

4.4 Treatment

The enlargement progresses to 12months after starting the drug and regresses after stopping of the dosage.

5. CALCIUM CHANNEL BLOCKERS

Antihypertensive drugs in the calcium channel blocker group are used extensively in elderly patients who have angina or peripheral vascular disease[6]. It includes nifedipine, felodipin, verapamil,diltiazem, amlodipine and isradipine. CCB are administered for the treatment of cardiovascular diseases which includes hypertension, angina pectoralis, arrhythmia and coronary artery spasm[15,17]. The use of calcium channel blocker in conjunction with cyclosporin can also affect the prevalence or severity of gingival enlargement.

5.1 Clinical changes

The changes in gingiva appears 1-3months after administration. It is more common in men than women. In addition to gingival enlargement, tachycardia and facial redness can be seen[9].

5.2 Histopathology

The gingival epithelial proliferation was more responsible for gingival enlargement than connective tissue proliferation[18].

5.3 Pathogenesis

Calcium channel blockers affects the Calcium metabolism by decreasing the intracellular Calcium flow and limiting the production of active collagenase. The inflammatory cytokines such as IL6 and IL1b also plays an important role in physiological response to calcium channel blockers. Thenifedipine which is lipophilic easily penetrates into the cells when compared to the polarized amlodipine and this structural difference plays an important role in drug-induced gingival enlargement. A large portion of amlodipine remains in the tissue and it is not observed freely in the circulation. Amlodipine rarely reaches the threshold required to cause gingival enlargement[9].

5.4 Treatment

Full recovery of gingival enlargement occurs at 4months after stopping the drug. If no abnormality develops, isradipine is replaced by following the protocol[9].

6. CONCLUSION

Gingival enlargement can cause problems in controlling plaque, chewing, teething, speech and aesthetics (1).Treatment is based on the administered drug and clinical characteristics and it can include non-surgical treatments, surgical treatments as

drug replacement. Gingival enlargement is an under recognized effect of calcium channel blockers, immunosuppressants and anticonvulsants. Doctors can identify the problem by looking in thepatients mouth and refer for further treatment.

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SP-20

Metastasizing Ameloblastoma

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Abstract: Ameloblastoma is a benign odontogenic tumour which is locally aggressive and has a high recurrence rate. Though it is the most common odontogenic tumour, the incidence of its metastasis is low and once the metastases occur, which are uncommon, lungs represent the most common site involved. Malignant ameloblastomas are different from ameloblastic carcinomas. Malignant ameloblastomas are tumours considered metastatic despite the appearance of well-differentiated or benign histology, while ameloblastic carcinomas are histologically malignant in both primary and metastatic sites.

Keywords: Malignant ameloblastomas, Metastasizing ameloblastomas, metastasis.

1. INTRODUCTION

Ameloblastoma is a locally invasive neoplasm originated from odontogenic epithelium. The tumor is composed of proliferating odontogenic epithelium which is of enamel organ-type tissue that did not undergo differentiation to the point of hard tissue formation. Characteristically, the tumor lacks enamel and dentin. It has been postulated that the epithelium of origin is derived from one of the following sources-

a) Epithelial lining of odontogenic cyst
b) Dental lamina or enamel organ.
c) Basal cells of surface epithelium
d) Disturbances of developing enamel organ
e) Heterotopic epithelium of other parts of body.

Ameloblastoma is a benign odontogenic tumour which undergoes malignant transformation to ameloblastic carcinoma. However, seldom it metastasizes without undergoing cytological malignant changes, an entity denoted as Metastasizing Ameloblastoma (MA). The term metastasizing ameloblastoma is used to describe a tumour that shows histologic features of classic ameloblastoma in the gingiva or jaw and has metastatic deposits elsewhere. Histologically it is a benign conventional ameloblastoma that metastasizes to different sites and both primary and secondary lesions have histological features of benign ameloblastoma.[1]

2. CLINICAL FEATURES AND METASTASIS

Typically, the primary ameloblastoma arises in mandible of a young adult with average range of presentation being 20-30 years. Metastases are uncommon, which is why metastatic ameloblastoma is considered benign (in addition to the benign features on histology) and generally may manifest after an interval ranging from 10 to 12 years [2]. The metastatic nodules if develops mostly found in lungs (80%), cervical lymph nodes (15%) or extra gnathic bones. Typically, the pulmonary metastasis is multifocal and involve both lungs. The median survival after discovery of metastatic lesion is about two years. Innocuous 'lung granulomas' that are seen on routine chest radiographs of a patient with ameloblastoma can prove to be silent metastasis and it was noted that most patients had multiple recurrences of jaw ameloblastoma. The multiple recurrences could result either from an intrinsically more aggressive tumour, i.e., one that is more proliferative or more infiltrative or from surgery associated tumour "spillage" into adjacent tissue or tumour embolization into lymphatic or blood vessels [3,4]. The pulmonary metastasis can be due to aspiration of tumour fragments during multiple surgical procedures, for recurrent ameloblastoma though it is debatable. The intravascular spread through tumour emboli disseminated by way of blood or lymphatic vessels is more convincing. [3] Because of lack of morphological criteria of malignancy, the biological behaviour of ameloblastomas cannot be predicted. It is difficult to decide about the factors that can be important in the delayed induction of metastasis. It is hypothesized that ameloblastomas possess an inherent low-grade malignancy which is stimulated by multiple recurrences. It is also suspected that the metastatic tumour cells have a slow growth rate, resulting in late clinical manifestation of metastases.

3. PROPOSED MECHANISM FOR METASTASIS OF METASTASIZING AMELOBLASTOMA

When trying to hypothesize the metastatic cascade associated with MA, it was found that benign and malignant tumour follows the same pathway till the blood vessels. However, MA exhibits surprisingly a different behaviour by intravasating into the blood vessels and metastasize. Primary tumour cells of MA manifest EMT by a method called "cadherin switch" by switching E-cadherins to N-cadherins. Now, surge in N cadherins results in two processes – Firstly, cytoskeleton rearrangement occur via

"Rho induced stress fibers", and secondly, by formation of invadopodia through activation of RAC1.[5] Tumor cells increase Src activity by interacting with transmembrane receptors (epidermal growth factor receptor, platelet-derived growth factor receptor, and fibroblast growth factor receptor) which engages with receptor tyrosine kinase intracellularly and integrins extracellularly result in increase in Src activity.[6,7]Activation of Src leads to phosphorylation and activation of mitogen-activated protein kinase which is responsible for regulation of cytoskeleton invadopodia formation and increases in MMP (MMP2, MMP9) activity for migration (single cell migration [SCI] or collective cell migration [CCI]) and invasion of tumour cells.[7,8] At the endothelial lining, tumour cells will take two ways to enter into the vessels. One way is transcellular and another is paracellular intravasation. The entry of tumor cells through the endothelial cells via cell junctions occurs under the influence of various cytokines such as EGF1, TNF1 alpha, and protease-activated receptor 1 (PAR1). Finally, it results in distant metastasis. [8]

4. MOLECULAR MARKERS

Application of various immunohistochemical (IHC) markers have been made to discover the unrevealed aspect of metastasis in MA. The markers which could help in determining their implications in the invasive process of MA, and lacks cytodifferentiation of odontogenic epithelial cells are as follows- Among the important studied markers given in the literature most recognized one is RAS. RAS is a signal transduction protein which regulates malignant transformation and is the most commonly mutated gene in human tumors (about 85% of total) including oral squamous cell carcinoma (OSCC) (5%–50%). Mutational detection of kRAS has clinical importance in prognosis and treatment of various malignancies.[11] Kumamoto et al. carried out an IHC study on kRas, kRaf, and MEK ERK1 and found peripheral and central cells of MA to be moderately positive (++) for these markers on DNA sequencing; The study revealed that out of two MAs, only one exhibited point mutation of kRas which provided with the idea that kRas has an important role in neoplastic transformation of odontogenic epithelium.[9] Kumamoto et al. carried out a study on SHH, PTCH, SMO, and GLI in MA and found that SHH and PTCH were strongly positive (++). MA showed GLI and SMO expression in neoplastic cells as well as stromal cells. GL11 showed strong reactivity in neoplastic cells as compared to stromal cells. High immunoreactivity for p63 in epithelial odontogenic tumours has been found in peripheral neoplastic cells than in central neoplastic cells. Increased expression of p63 and p53 was found which suggested that they have a role in proliferation of odontogenic epithelium. Raised expression of isoform denotes their role in oncogenesis and neoplastic transformation of odontogenic epithelium.[10] (TNF) alpha acts as an endogenous tumour promoter in carcinogenesis process. TNF accelerates the epithelial– mesenchymal transition (EMT) and was linked to the acquisition of an invasive phenotype. [11-13] It has been found that TNF-alpha was positive in neighbouring cells adjacent to the basement membrane. TRAIL was manifested in most peripheral columnar or cuboidal cells and in few central polyhedral cells.[14.] Kumamoto and Ooya studied and showed positive activity of NF-k in all peripheral cells of MA, suggesting its role in oncogenesis and tumor progression.[14] =Other markers are described in a chart form as follows

STUDY	POSITIVE MARKERS	NEGATIVE MARKERS
Kumamoto et al., 2005[14]	β catenin, APC (++)	
Kumamoto et al., 2005[14] Fujita et al., 2006	Cytochrome, APAF1 (++), Caspase-9 (++), AIF (++) B), APC (++)	
	Neoplastic cells - BMP-2 (+), BMP-4 (+/++), BMP-7 (++/+++), BMPRs (++/+++), CBFA1 (++) Stromal cells - BMP-2 (+), BMP-4 (+), BMP-7(+), BMPR'S (+/++), CBFA1 (+)	Nestin
H Kumamoto et al., 2006[21]	MTI-MMP (++), RECK (++), EMMPRIN (++)	
H Kumamoto et al., 2007[22]	pAkt (+/++), P13k (+/++), PTEN (+/++)	
Kumamoto 2007[22]	P-P38MAPK (+,-), p-ERK5 (+)	p-JNK
H Kumamoto et al., 2008[23]	Neoplastic cells - Bid (++), Bim (++), Bad (++) (peripheral) Stromal cells - Bid (+/++), Bad (+)	
Kumamoto et al., 2010[23]	CD133 (+), Bmi-1 (++), ABCG2 (++)	
Kazuma Noguchi et al., 2013[21]	Ki 67 +++	
Rui B et al., 2015[21]	Stellate cells - CK10/13 (+), Spindle cells - p63 (+)	

5. FUTURE PROSPECTS OF METASTASIZING AMELOBLASTOMA

It was found that MA is a confusing lesion bearing a few malignant characteristics. At clinical level, it is very difficult to assess its malignant potential. So careful assessment should be done to diagnose this pathology and give necessary therapy.
Following are some future prospects which should be taken into account

5.1 Role Of Histopathological Malignant Features

The underlying cytodifferentiating character and highlighted metastatic character are two significance/vital intrinsic dispositions of MA. The Notch pathway was shown to be important for cytological differentiation or acquisition of tissue-specific

characteristics in neoplastic cells of odontogenic neoplasms. Notch 1 signalling is activated in the neoplastic epithelium. It was found that activated Notch 1 results in the translocation of Notch to the nucleus and causes cycle arrest; however, Notch1 signalling is related to the acquisition of morphological characteristics in tumorigenesis.[15]

5.2 Tumour Microenvironment

TM consists of stromal myofibroblasts. Stromal myofibroblasts are capable of invading cells and promoting cancer cell invasion.[16]They can also secrete various cytokines (IL-8 and VEGF) and chemokines (e.g., CXCL12). They mainly communicate with cancer cells through a cyclic peptide known as the CXCL12 in order to control cancer cell migration[17]. These tumours myofibroblasts then form invading channels through ECM from which carcinoma cell pass through by maintain their epithelial characteristics [5].

5.3 Difference Between Ameloblastoma And Metastasizing Ameloblastoma

Histopathologically, it is hard to differentiate between MA and non-MA. Studies on MA revealed that certain markers can be linked to its pathophysiology [18,19,20,21]. A study revealed that the altered expression of p-p38 MAPK and p-ERK5 proteins could be involved in the development of neoplastic epithelium [22].

5.4 Role Of Epithelial–Mesenchymal Transition

Various studies have revealed that certain markers in MA have a significant role in the development of metastatic ameloblastoma [23,24]. Findings related to EMT suggest that further studies should be conducted on the role of EMT genes like Snail, Slug, SIP1, and Twist in the disease. It has been hypothesized that these regulators might play a role in odontogenic tumors either acting alone or in concert of EMT [25,26].

6. CONCLUSION

Usually, any malignant tumor cells bear dysplastic morphologic features and mutational molecular characteristics which results in distant metastasis. However, in MA, instead of having benign morphologic features, it surprisingly metastasizes. It will be beneficial to obtain meaningful differentiating features in non-MA and MA for future aspects.

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SP-21

Oral Ulcers And Its Differential Diagnosis

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Abstract: The diagnosis of oral ulcerative lesions might be difficult. Because of the clinician's limited exposure to the causes that may induce the lesions and their similar features, diagnosing and treating oral ulcers can be difficult. While most oral ulcers are caused by continuous damage, others may be signs of a more serious underlying problem, such as gastrointestinal dysfunction, cancer, immunologic abnormalities, or cutaneous disease. Clinicians who treat patients with oral mucosal infection must make sure that a definitive diagnosis is made correctly. Although some of these illnesses are contagious, the majority are chronic, symptomatic, and desquamative. Understanding the immunopathologic nature of the lesion is necessary for treatment and management. This article will explain how to distinguish and diagnose different forms of oral ulcers, as well as how to treat them.

Keywords: Oral ulcer, cancer, gastrointestinal dysfunction, immunologic abnormalities

1. INTRODUCTION

Defects in the epithelium, underlying connective tissue, or both describe ulcers[1]. Oral ulcerative lesions can be difficult to diagnose due to the wide range of causal variables and presenting symptoms[2]. Nonneoplastic and neoplastic lesions regularly afflict the tongue, with the latter being characterised by a gradual growth that can be benign or malignant. Non-neoplastic lesions are either inflammatory or a reaction to a variety of irritative stimuli, and they are frequently identified by chance during normal oral examinations[3]. The present study explains some of the differential diagnosis of oral ulcers.

2. Neoplasm
2.1 Squamous cell carcinoma

3 Reactive lesions
3.1 Trauamatic ulcer
3.2 Apthous stomatitis
3.3 Oral lichen planus

4 Vesiculo bullous lesions
4.1 Pemphigus vulgaris
4.2 Mucous membrane pemphigiod
4.3 Erythema multiforme

5 Viral causes of ulceration
5.1 Herpes simplex virus 1
5.2 Herpes simplex virus 2
5.3 Epstein barr virus
5.4 Human immune deficiency virus

6 Bacterial causes of oral ulceration
6.1 Treponema pallidum
6.2 Tuberculous ulcer

7 Oral ulcers due to systemic conditions
7.1 Granulomatosis with polyangitis
7.2 Bechet's syndrome

2. NEOPLASM

2.1 Squamous Cell Carcinoma

Oral squamous cell carcinoma (SCC) can appear as a white lesion (leukoplakia), a red lesion (erythroplakia), a red and white lesion (erythro leukoplakia), an indurated mass, or a mucosal ulcer or lumps, granular ulcers with tissue infiltration and elevated exophytic edges, or a nonhealing extraction socket are the most common symptoms[1]. As a result, clinicians should be

aware if any of these symptoms last longer than two weeks because it could be a sign of oral cancer.among other clinical manifestations. The most prevalent intraoral locations for this cancer are the floor of the mouth and the lateral tongue. Tobacco usage and alcohol use are two important risk factors for oral cancer. SCC of the lip, which is typically connected with UV light and pipe smoking, manifests as a chronic, nonhealing ulcer at the vermillion border[1]. Several other ulcerative disorders, such as recurrent herpes simplex virus 1, can resemble this type of malignancy in appearance (HSV-1) the 5-year survival rate for cancer of the lower lip is 90%, which is higher than the 40- to 50 % of 5-year survival rate for intraoral cancer. Nodal metastases are found in about 80% of tongue cancers at the time of diagnosis, which contributes to the lower 5-yea. SCC of the oral cavity can appear to be a number of different benign conditions at different times. As a result, at each dental or medical appointment, a thorough soft tissue examination should be done. Any ulcer that has been present for more than two weeks and cannot be explained should be referred to a specialist[1].

3. REACTIVE LESIONS

3.1 Trauamatic Ulcer

Traumatic injuries are relatively common oral mucosa. Mechanical injury (contact with sharp foodstuffs; unintentional biting during mastication, chatting, or even sleeping) as well as thermal, electrical, or chemical burns cause them[1, 2]. The tongue, lips, and buccal mucosa are the most prevalent sites for traumatic ulcers. Traumatic lesions of the oral cavity were most commonly detected on the buccal mucosa (42%) followed by the tongue (25%) and the lower lip (9%)[4], according to Chen et al men are more likely than women to develop traumatic ulcers (male to female ratio of 2.7:1). Traumatic ulcers can also occur as a result of mucosal injury while the patient is still anaesthetized after dental treatment. These lesions can last a few days or even weeks, especially in the form of tongue ulcers caused by recurrent assaults to the tongue.

3.2 Recurrent Apthous Stomatitis

Recurrent aphthous ulcers (RAS), sometimes known as 'canker sores,' are divided into three types based on their size and appearance. Minor aphthae can be single or many, have a diameter of 2-5 mm, are shallow, and heal without scarring. Major aphthae, on the other hand, are usually single, more than 5 mm in diameter, deep, and scar when healed. Nonkeratinized tissues such as the labial and buccal mucosae, alveolar mucosa, and soft palate are susceptible to minor and major aphthae. Herpetiform aphthous(<1mm) ulcers are a rare type of aphthous ulcer that occurs in clusters. A yellow-gray pseudomembrane covering, rounded shape, and red (erythematous) halo characterise all types of aphthous ulcers. Immunity mediated by pathogenesis may be essential.Treatment options are broad and palliative because both mild and herpetiform aphthous ulcers normally heal in 7-10 days. Tetracycline or doxycycline mouth rinses, topical corticosteroids (fluocinonide), and silver nitrate cauterization have all been used as treatments. The latter relieves aphthae pain via necrosis of tiny nerve fibres, but it usually leads to protracted healing of aphthous ulcers, which is not fully defined, but involves changes in local cell. Corticosteroids, either intralesional or oral, are used to treat serious aphthae. Oral corticosteroids may be combined with steroid-sparing medicines like azathioprine or mycophenylate to treat extensive, persistent illness. Colchicine, dapsone, and pentoxifylline have also been used with different degrees of success for serious aphthae[6]

3.3 Systemic Disorders Associated With Recurrent Aphthous Ulcers

Oral aphthous ulcers can cause a variety of systemic issues, including Behçet's syndrome, celiac disease, cyclic neutropenia, nutritional deficiencies, Immunoglobulin A (IgA) deficiency, MAGIC syndrome (mouth and genital ulcers with inflamed cartilage), and Sweet syndrome (febrile neutrophilic dermatosis). Aphthous ulcers in these patients appear clinically similar to those in patients without systemic illnesses. It's critical to inquire about any gastrointestinal problems, whether they've been diagnosed or not. Oral ulcers can become a major condition if they become chronic.

3.4 Oral Lichen Planus

Oral lichen planus (LP) is a mucosal form of lichen planus with a wide range of clinical characteristics. Oral LP can be reticular (white papules and plaques), atrophic (erythematous; plaque-like), or erosive (erosions and ulcers). The majority of people with reticular LP are asymptomatic. The erythematous and erosive variants of LP are more commonly associated with pain. The buccal mucosa is the most common intraoral location, however the tongue, lips, palate, gingiva, and mouth floor can all be involved. Hyperkeratosis, degradation of the epithelium's basal cell layer, and the appearance of a subepithelial band of lymphocytes are all signs of LP [2,4]. Direct immunofluorescence (DIF) is a valuable diagnostic test for demonstrating fibrinogen depositions beneath the basement membrane. Patients with symptoms or complaints that point to the involvement of other mucosal locations should be sent to a specialist for further investigation. There is no need for treatment if the patient is asymptomatic; however, if the patient has symptoms and/or ulcers, topical or systemic corticosteroids may be utilised as a treatment option[1,2].

4. VESICULO BULLOUS LESIONS INDUCED ULCERS

4.1 Pemphigus Vulgaris (PV)

PV is a persistent vesiculobullous mucocutaneous autoimmune illness marked by a lack of cell adhesion (acantholysis) and the production of blisters. Oral lesions appear in over 90% of PV patients, and in more than half of those cases, they are the initial sign of disease[7]. On a noninflamed base, oral lesions begin as bullae. Because the bullae rupture quickly, physicians are more likely to discover shallow irregular lesions. Over the course of weeks, the edges of lesions continue to spread out until they cover extensive regions of the oral cavity. The lesions usually begin on the buccal mucosa, but they can also affect the palate and gingivae[1]. Lesions can be as little as a 5 mm aphthous ulcer or as large as a severe psuedomembrane-covered lesion (2 cm). Due to significant pain during food ingestion, the severity of oral lesions can limit appropriate nutrition. PV must be separated from other erosive mucosal disorders such as mucous membrane pemphigoid, erosive LP, and erythema multiforme in terms of clinical manifestations. A biopsy is needed to determine the location of the epithelial separation (acantholysis) and, in most cases, DIF is used to locate the autoantibody linked to the tissue in the suprabasal portions of the stratum spinosum (IgG and C3)[1,7].Almost all cases of PV necessitate the use of systemic corticosteroids, which are frequently combined with nonsteroidal immunosuppressants like Mycophenolate or azathioprine .Topical corticosteroids may be administered if there is less severe form of oral involvement cases but this is not common[1,8].

4.2 Mucous Membrane Pemphigoid

Mucous membrane pemphigoid (MMP) is also called benign mucous membrane pemphigoid, cicatricial (scarring) pemphigoid, and ocular cicatricial pemphigoid. MMP is a frequent immune-mediated subepithelial blistering condition that mostly affects the oral mucosa (over 90% of cases), although skin lesions can also occur in 20% to 30% of cases. Gingivae are the most affected area in the oral cavity, followed by buccal mucosa and palate. It affects twice as many women as it does men, and it usually affects those over the age of 50[2]. Desquamative or erosive gingivitis is a term used to describe lesions that are isolated to the gingiva. Only gingival erythema and edoema are seen in certain moderate cases of MMP, which dentists mistake for gingivitis. Because eye lesions are common and scarring of the canthus (symblepharon), corneal scarring, and eyelash inversion (entropion) can cause to visual difficulties, an ophthalmologist is usually included in the MMP diagnosis and long-term care team. Epithelial separation at the basement membrane level without acantholysis can be seen microscopically. The target proteins laminin-5 and bullous pemphigoid antigen-180 are shown to have a linear distribution of IgG and C3 localised at the basement membrane in DIF (BP-180). Depending on the degree and scope of the condition, MMP can be treated with topical or systemic corticosteroids. Corticosteroid treatment is sometimes combined with nonsteroidal immunosuppressants like azathioprine or mycophenolate in refractory cases.

4.3 Erythema Multiforme

Erythema multiforme (EM) is a hypersensitive reaction that causes unique target-like lesions on the skin, as well as erosions of the oral and vaginal mucosa. It's characterised by irregular red macules, papules, and vesicles that merge with one another to become larger and form target lesions on the skin . Large pseudomembrane-covered ulcers on the buccal mucosa, ventral tongue, and labial vestibule are common intraoral lesions followed by bullae and ulcerations with irregular boundaries and an inflammatory halo. EM is characterised by hemorrhagic crusting of the lips' vermillion border which is a diagnostic sign[9,10]. Although the oral mucosa can be damaged alone, cutaneous lesions frequently accompany those detected in the oral cavity. Erythema multiforme major is a drug-induced erythema that affects both the skin and the mucous membranes. Erythema multiforme minor is a non-mucosal erythema caused by HSV infection. Sulfonamides, penicillin, cephalosporins, quinolones, analgesics, and nonsteroidal anti-inflammatory drugs (NSAIDs) can all cause EM, as can a variety of viruses (herpes simplex virus, Epstein-Barr virus, Cytomegalovirus, Varicella Zoster Virus, fungal agents, and parasites)[9]. EM usually strikes young adults (20–40 years old) and teenagers, although it can strike anyone at any age, including those who are 50 years old or older. With a male to female ratio of 3:2, there is a male preference[11]. Corticosteroids and, in some cases, acyclovir are used to treat both minor and serious EM. Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis (TEN) are currently regarded to be more severe symptoms of bullous EM. SJS is defined as skin detachment of less than 10% of the body surface, whereas TEN is defined as skin detachment of more than 30% of the body surface. Sepsis and septic shock (S. aureus and P. aeruginosa) are the leading causes of death in individuals with SJS/TEN. Blood, wounds, and mucosal lesions should all have suitable cultures taken because of the high risk of bacterial superinfection and sepsis[1]. Infection with Mycoplasma pneumoniae should also be evaluated in children.

5. VIRAL CAUSES OF ULCERATION

5.1 Herpes Simplex Virus: Type 1

The most frequent symptom of herpes simplex virus (HSV) infection is primary herpetic gingivostomatitis. HSV type 1 is responsible for around 90% of instances, whereas HSV2 is responsible for the remaining 10%. In young people, it may be asymptomatic or extremely mild, but it is linked to more severe general symptoms in the elderly[12]. The majority of occurrences occur between the ages of 6 months to 5 years, with the highest prevalence occurring between the ages of2 to 3 years. Initial symptoms include fever, nausea, anorexia, and irritability. Oral signs include a widespread gingivitis that is followed by pin-headed vesicles that burst easily and cause painful ulcers covered by a yellowish pseudomembrane after 2-3 days[1,2,12]. They usually merge to form bigger ulcers. Mucosa that is keratinized or nonkeratinized can be damaged, and the number of lesions is vary. Punched-out erosions along the free gingival margin have been described in many cases[4]. In the majority of cases, submandibular lymphadenitis, halitosis, and difficulties swallowing are observed. It's worth noting that some adult patients may have pharyngotonsillitis. Furthermore, the oral mucosa anterior to Waldeyer's ring is involved in about 10%

of cases. The ulcers normally heal without scarring within 5 to 7 days, however they might last up to two weeks in extreme situations[13].

5.2 Herpes Simplex Virus: Type 2

HSV-2 is transmitted orogenitally and can cause mouth ulcers similar to those caused by primary HSV1 infections.

5.3 Epstein-Barr Virus

Hairy leukoplakia, a white lesion on the lateral border of the tongue, is the most classic condition of EBV infection. EBV-positive mucocutaneous ulcer is a rare form of EBV infection that occurs in immunocompromised people. This is an indolent, self-limiting condition that responds well to conservative treatment. A polymorphous infiltration and atypical big B-cell blasts, typically with Hodgkin/Reed-Sternberg (HRS) cell-like morphology, describe lesions histologically. In an environment of numerous T cells, the B cells display significant CD30 and EBER (Epstein-Barr virus encoded small RNA) positivity, with some showing reduced CD20 expression.

5.4 Human Immuno Deficiency Virus

Infection with the human immunodeficiency virus (HIV) can result in a range of oral ulcers, including severe necrotic ulcers with no recognised cause. Ulcers can be unpleasant and induce dysphagia. The mucosa of the buccal and pharyngeal cavities is the most usually affected. The cause of these HIV-related ulcers is uncertain, while it was first thought to be Cytomegalo virus(CMV). Antiinflammatory medications such as thalidomide and tumour necrosis factor alpha (TNF) blockers are used to treat these ulcers.

6. V BACTERIAL CAUSES OF ULCERATION

6.1 Treponema Pallidum

Treponema pallidum, a spirochete, causes the disease, which has 3 distinct phases. Primary syphilis manifests itself as a chancre at the site of infection. Oral chancres are a common complication of orogenital contact. Chancres begin off as a tiny papule that grows larger, enlarges, erodes, and ulcerates. The lesion is typically punched-out, indurated, and around 2-3 cm in diameter, without red inflammatory border. A yellowish, highly infectious, serous discharge covers the surface[2]. Chancres usually last 2–4 weeks and heal on their own. Oral lesions such as red macules, pharyngitis, or isolated/multiple painless, shallow, and highly infectious ulcers surrounded by an erythematous halo are all symptoms of secondary syphilis. The uneven boundaries may resemble "snail tracks." In about 30% of untreated syphilis cases, tertiary syphilis develops many years after the initial infection. Gummas, palatal perforation, and neurological problems are the most common symptoms. For all phases of syphilis, penicillin-G remains the antibiotic of choice[1].

6.2 Tuberculous Ulcer

Tuberculosis and leprosy are two granulomatous illnesses that can induce ulcerative sores in the oral cavity[15]. Oral mucosa is rarely affected by tuberculosis in about 1.4 % of all TB cases, with a male to female ratio of 4 : 1[14,]. The tongue, gingivae, floor of the mouth, palate, lips, and buccal mucosa are the most common sites for the classic oral lesion, which usually manifests as a solitary ulcer with an undermined edge. In the meanwhile, it may be ragged and indurated, as well as painful. Traumatic ulcer, syphilitic ulcer, and oral Squamous cell carcinoma are all possible diagnoses for tuberculous ulcer[14].

7. ORAL ULCERS DUE TO SYSTEMIC CONDITIONS

7.1 Granulomatosis With Polyangitis

Oral ulcers are a symptom of(GPA); granulomatosis with polyangitis (Wegner's Granulomatosis), which is characterised by upper respiratory tract, lung, and kidney involvement. The first signs of the disease are usually painful cobblestone alterations on the mucosal surface of the palate and gingiva (strawberry gingiva). GPA is a necrotizing vasculitis with granulomatous inflammation. Having a high GPA can lead to palatal perforation. The presence of anti-neutrophil cytoplasmic and peri-nuclear antibodies (cANCA, pANCA) on cytological examination confirms the diagnosis. ; however, their absence does not rule out the diagnosis. Corticosteroids and cyclophosphamide are used in the treatment of this condition[16].

7.2 Behçet's Disease

Behçet's illness is a chronic inflammatory disease that affects many organ systems and has no recognised cause. Diffuse aphthous-appearing mucosal erosions are the most common oral lesions. The International Criteria for Behçet's Disease (ICBD) set out criteria in 2006 in an attempt to better describe the disease using a point system. Behçet's Disease is diagnosed with three or more points (genital aphthosis has two points, ocular lesions has two points, and the remaining has one point

each [skin, mouth aphthous, vascular lesion]). Behçet's syndrome has no consistent treatment. Corticosteroids, azathioprine, thalidomide, and Dapsone have all been tried and proven to be effective[1, 2, 4].

8. CONCLUSION

The diagnosis of oral ulceration can be difficult, and it necessitates a thorough clinical examination and a complete medical history. It's critical to recognise that oral symptoms could be a symptom of a greater problem. A biopsy may be necessary to confirm a correct diagnosis.Any ulcer in the oral cavity that does not heal within two weeks should be examined microscopically.

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SP-22

Psychosocial Impacts Of Halitosis

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Abstract: The terms halitosis, oral malodor, bad breath, fetor ex-ore, or fetor- oris are used to describe an unpleasant odor that is consistently emitted from an individual's oral cavity. The Unpleasant breath is caused by odorous compounds that can be found in the environment. Either extrinsic or intrinsic in nature. Bad breath, or halitosis, is a common social obstacle that can lead to psychological difficulties. Patients with this ailment frequently seek the help of a variety of specialists for diagnosis and therapy. Only with a proper diagnosis and understanding of the cause can effective treatment be obtained. It should be highlighted that, in order to avoid misdiagnosis and inappropriate treatment, a multidisciplinary approach including general practitioners from multiple departments are required to solve the problem. Changes and contradictions in etiological factors and therapeutic techniques for halitosis, as reported in the literature, require further inquiry and analysis. The main aim of this literature is to assess the causative factors, the different diagnostic methods, and treatment options required in maintaining oral health as well as restoring an individual's mental health, self-confidence, and social status. Individual's social and psychological manifestations that are conditioned by halitosis are kept in mind while studying the above mentioned parameters.

Keywords: Halitosis, oral malodor, Bad breath, psychological effect.

1. INTRODUCTION

Halitosis is a disease may interfere with social contact, resulting in psychological changes that eventually lead to social and personal isolation [1]. It impacts everyone at some point in their lives and can be caused by a number of causes. The true prevalence of halitosis is unknown due to the difficulty of objective evaluation. After examining the whole population, Miyazaki et al. found that 6+23 % has malodor that is above the socially acceptable range.[2, 3] in clinical practice, some individuals with halitosis have actual malodor, whereas others have absolutely no malodor. It's been hypothesized that halitosis is a symptom linked to both physical and mental well-being, and that psychological illnesses are closely linked to the condition's reporting in the few of the patients[4]. Every day, people contact with one another, and halitosis has a detrimental impact on one's social life. Because the individual with halitosis may have developed tolerance or olfactory disturbance, he or she may be unaware of the problem. Because of this, the patient is unable to detect his or her halitosis, which is detected by his or her partner, family member, or friends [5, 6]. People with halitosis experience distress as a result of their illness, and they may avoid social interactions [7]. Halitosis is primarily caused by microbial amino acid metabolism in local debris. Volatile sulphur compounds (VSCs), such as hydrogen sulphide (H2S), methyl mercaptan (CH3SH), and dimethyl sulphide, are among the most common contributors to oral malodour (CH3SCH3). In individuals with halitosis, VSC levels are usually assessed and an organoleptic test (OLT) is performed to determine the level of oral malodor [5]. In comparison to the older age group, patients in the younger age group (53.5 %) had a higher incidence of halitosis. Younger people become aware of the changes in their bodies that occur as a result of puberty, and they are frequently subjected to peer pressure as a result of their surrounding[8, 9, and 10]. Halitosis has been linked to psychological qualities like despair, anxiety, paranoid ideation, and aggression, according to studies. These characteristics may contribute to a lack of desire in maintaining oral hygiene, exacerbating the problem [11]. Halitosis affects people of all ages however, the severity of bad breath increases with age, which may be influenced by the development of xerostomia. Approximately two-thirds of the population suffers from occasional halitosis during the day, whereas 5% of the population suffers from severe halitosis that necessitates immediate assistance. The article's focus is to look at the causes, diagnostic tools, and treatment choices for maintaining dental health while also restoring an individual's mental health, self-confidence, and social position[1].

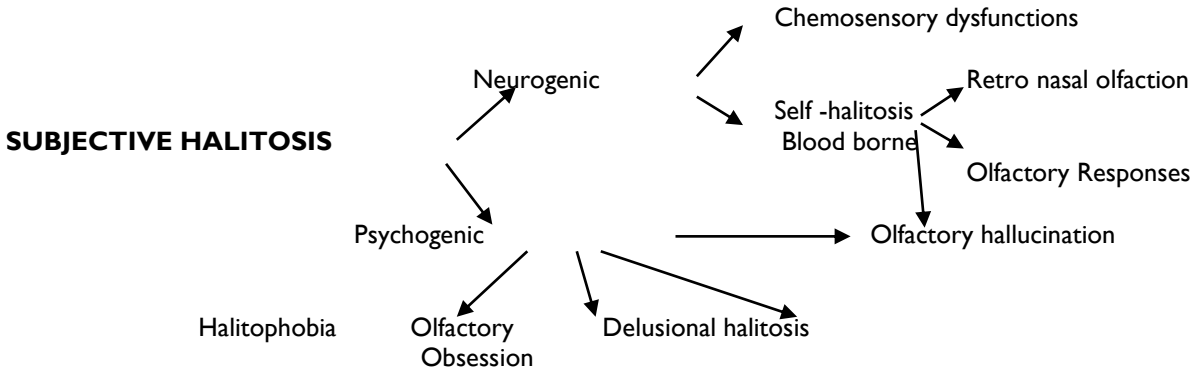
2. ETIOLOGY

Pathological halitosis is caused by intraoral and extra oral reasons. The majority of bad breath cases (80-85%) are of intraoral nature The main pathophysiology of bad breath is the degradation of organic compounds(e.g., saliva, food debris,desquamated epithelial cells into primarily volatile sulphur compounds (VSCs)} in the oral cavity caused by proteolytic anaerobic bacteria[1,7]. Bacteria such as Porphyromonas gingivalis, Fusobacterium nucleatum, and Prevotella intermedia cause foul odor in the mouth. These Gram-negative anaerobic infections can create odoriferous substances such as methyl mercaptan, hydrogen sulphide, and dimethyl sulphide, which are known as volatile sulphur compounds (VSCs) [2]. Although other organic components such as organic acids, indole/skatole, putrescine, and cadaverine may be implicated in the development of halitosis. The dorsum of the tongue posterior to circumvallate papillae consistently carry highest load of bacteria and main source of malodorous gases[12,13]. Open caries lesions, insufficient dental restorations, periodontitis, odontogenic infections, local infections such as pericoronitis, periimplantitis, or candidiasis, as well as poor oral and denture care, are the additional intra-oral causes. Reduced

salivary flow has a negative impact on the self-cleaning action of saliva. As a result, volatile chemicals are produced, resulting in halitosis. Saliva's antibacterial action is reduced as a result of decreased salivation, and Gram-positive species become Gram-negative. Diabetes, Sjogren's syndrome, long-term stress, depression, drug use, mouth breathing habit, and alcohol misuse may all cause hypo salivation leads to halitosis and increased caries activity[14]. In clinical practice, some people with halitosis have true malodor, whereas others have almost no malodor. Halitosis classified as genuine halitosis, pseudo halitosis, and halitophobia. Genuine halitosis is treated with periodontal treatment, dental and oral care, oral hygiene instructions, and counseling, whereas pseudo halitosis is treated with counseling that includes education and explanations of examination results showing that the patient's malodor is not beyond a certain limit[15]. Halitosis is thought to be a symptom of both somatic and emotional distress, with psychiatric illnesses being strongly linked to the condition in some people. Patients with halitosis who have psychological issues, such as halitophobia, do not exhibit oral malodor, according to prior studies [16]. Patients with oral malodor, as well as those who do not have oral malodor, may have a psychiatric illness.

3. SUBJECTIVE HALITOSIS

Subjective halitosis terms and concepts were recently changed and redefined. As a result, there are two types of subjective halitosis: Neurogenic and Psychogenic. Nonmeasurable halitosis, or subjective halitosis, has no psychopathologic significance.



3.1 Neurogenic Halitosis

There has been a lot of research done on neurogenic forms of subjective halitosis. There is a real chemical stimulus on the olfactory cells in this form, but no odorants are released into the from the mouth. The odor is solely perceived by the patient. In psychogenic forms of subjective halitosis, on the other hand, no chemical stimulation is elicited at the receptor level[11].

Chemosensory dysfunctions - Related conditions
- Dysosmia
- dysguesia
- Cacosmia
- Hyperosmia
- Parosmia
- Olfactory (including taste) receptor dysfunctions

Self-halitosis
- Retro nasal dorsolingual olfaction
- Blood borne olfactory receptor responses
- Olfactory hallucination (phantosomia)

3.2 Psychogenic Halitosis

Subjective halitosis has three psychogenic forms: halitophobia, olfactory obsession, and delusional.

3.2.1 ***Halitophobia*** is the most common variety, and it can be typically treated without psychologic medication by convincing the patient that the halitosis has been properly treated, and that the halitosis complaint will go completely.

3.2.2. *Olfactory Obsession*

If halitosis goes untreated for a long time, the next psychogenic type, odor obsession, develops. It's characterized by intrusive repetitive activities like brushing teeth or washing the mouth dozens of times, and it can overlap with obsessive-compulsive disorder phenomenological and neurobiological to variable degrees. Obsessive-compulsive disorders are characterized by

frequent and persistent intrusive and inappropriate ideas, thoughts, urges, or pictures that produce significant anxiety or distress. The patient is simply repeating the activity and/or thinking about the condition in cases of olfactory obsession.

3.2.3. *Delusional Halitosis*

Delusional forms of subjective halitosis develop when olfactory obsession and halitosis are persistent. These are defined by making observations about other people's actions. For example Patients may believe that their halitosis causes people to mock them, flee from them, and turn away from them

Halitophobia - Related conditions
-Halitosis anxiety
- Body odor psychosis
- Hypochondriasis
-Emotional disorder

Olfactory obsession- Obsessive compulsive disorder
Imaginary halitosis

Delusional halitosis- Olfactory delusion
- Olfactory reference syndrome
- Dysmorphic body odor
- Delusional bromosis
-Somatic delusional disorder

Imaginary halitosis refers to the last two types (olfactory obsession and delusional halitosis). Psychiatrists are the only ones who can cure imaginary halitosis. Each stage or type of subjective halitosis is distinct, although there are no clear distinctions between them. Patients with subjective halitosis may seek treatment from a dentist, who may struggle to discern between objective and subjective halitosis. Furthermore, there is a risk of misunderstanding or even misdiagnosis[11]. The term "social anxiety disorder" refers to a persistent worry or anxiety about one or more circumstances in which the individual may be scrutinized by others. Social contacts (e.g., having a discussion, meeting new people), being seen (e.g., eating, drinking), and performing in front of others are all examples (eg, giving a speech). Patients with objective halitosis may be self-conscious about their bad breath and avoid interacting with people in public places for fear of being judged.

4. MALODOR ASSESSMENT

Organoleptic testing, gas chromatography (GC), and sulphide monitoring are the three primary approaches for assessing oral malodour.Organoleptic measurement is a sensory test that scores a subject's mouth malodor based on the examiner's perception. Sulphur in mouth air can only be detected via GC, which requires equipment with a flame photometric detector. Because it is selective for volatile sulphur compounds (VSC).GC is regarded the gold standard for measuring oral malodor. BANA test, chemical sensors, salivary incubation test, beta-galactosidase activity quantification, ammonia monitoring, and ninhydrin method are some of the other measurement methods. For chair-side use, the BANA test is useful. It is a test strip that identifies short chain fatty acids and proteolytic obligate gram negative anaerobes that hydrolyze the synthetic trypsin substrate and produce halitosis. It identifies periodontal bacteria such as Treponema denticola, Porphyromonas gingivalis, and Treponema forsythensis [1, 4, 7.]

5. MANAGEMENT

It should not be forgotten that patients with halitosis require assistance and are frequently frightened and distrustful about any treatment. To provide proper therapy, a precise diagnosis is required. The goal of treatment is to eradicate the causative component, improve the hygienic status of the oral cavity, and eliminate the unpleasant mouth odor. The treatment can be carried out in a variety of ways, including mechanical and chemical reduction of microbes, odor concealment, and chemical neutralization of VSCs. Dietary changes, the use of sugar-free chewing gum, tongue brushing with a toothbrush, tongue scraping, and the use of zinc-containing toothpastes all contribute to clinically significant findings in the treatment of intraoral halitosis. Antibacterial ingredients in mouthwash liquids including triclosan, cetylpyridinium chloride (CPC), and chlorhexidine (CHX) inhibit the growth of bacteria that produce bad breath. Mouth rinse liquids containing CPC and CHX inhibit the development of VSCs, when most of those containing zinc and chlorine dioxide may neutralise halitosis-causing sulphur compounds.The only scientifically proven and clinically effective method to stop halitosis is to attack the ability of bacteria to produce VSCs and to convert the VSCs into non odorous and non-tasting organic salts. Another way to prevent bad breath is to simply replace the odorous bacteria in the oral environment with non odorous bacteria. probiotic Aktiv-K12, which is reintroduce the good bacteria (Streptococcus salivarius strain k12) into the oral environment[5,6]. The usage of oral hygiene products has a big impact on a person's social behaviour, and it's especially crucial for those who are self-conscious about their bad breath in social situations. When compared to patients without halitosis, patients with halitosis have significantly higher scores for anxiety, phobic anxiety, sadness, obsessive-compulsive disorders, and paranoid ideation. People who suffer from oral malodor frequently misinterpret the attitudes of those around them. As a result, patients should be informed that how people treat them has nothing to do with whether or not they have halitosis, but rather with the cause for their attitude[6].

People with halitophobia who attribute their emotional distress to a false mal odor should be referred to a clinical psychologist for mental evaluation and therapy in the early stages of the disorder[7.] Treatment of delusional halitosis necessitates a multidisciplinary approach involving psychologists and psychiatrists in addition to health care practitioners. Mutual understanding between the physician and the patient is crucial for a successful ultimate result in the treatment of halitosis. To alleviate the patient's stress, the physician should express acceptance, empathy, and reassurance [1, 7.11.]Patients with halitosis may be overly worried or more prone to neurosis since halitosis is not a self-evident symptom and can be perceived rather than a true symptom. In the halitosis therapy, it is vital to identify whether a physical or psychological approach is more appropriate for specific patients [4.] The patients' quality of life can be greatly improved by maintaining their social connections. The patient's primary healthcare provider, as well as family and friends, should offer support and reassurance on a regular basis. Considering the complex nature of halitosis, each case should be approached individually while monitoring the patient's treatment strategy. The primary healthcare professional, an ENT expert, a dentist, a gastroenterologist, a nutritionist, an endocrinologist, and a clinical psychologist are all included in the diagnosis and management[2.]

6. CONCLUSION

Halitosis is a significant obstacle to people's everyday life to establish and maintain social relationships, which has a detrimental impact on the individual's psychological condition. Because oral malodor is frequently conditioned by general somatic disorders and taking numerous medicines, early diagnosis of the problem is critical, and only the identification of the causative factors allows for proper and specific treatment involves medical specialists from various fields. As a result, treatment should focus on removing etiological causes and maintaining adequate oral hygiene. Finally Bad breath is described as a **"social handicap"** that causes the sufferer to avoid social situations.

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SP-23

Ridge Augumentation Techniques In Preprosthetic Surgery-A Review

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Abstract: Rehabilitation of missing teeth with dental implant-supported restorations has become a predictable treatment option in dentistry. The stability of hard and soft tissues around the implant is fundamental for long-term success. However, due to factors such as trauma, oncologic diseases, and missing teeth, vertical and horizontal bone loss is expected, and the available bone may not be suitable for optimum implant placement. Ridge augmentation procedures are applied to increase in the volume of the deficient sites for implant treatment. Autogenous block bone augmentation and guided bone regeneration (GBR) are two surgical approaches for implant placement. Autogenous bone is widely used for augmentations because of its osteogenic potential. A myriad of biomaterials, including xenografts, allografts, alloplasts, and composite grafts, are available for GBR. The aim of this chapter is to provide a brief summary of these methods and to discuss the advantages and pitfalls of ridge augmentation techniques.

Keywords: Alveolar ridge deficiency, guided bone regeneration, iliac block bone augmentation, biomaterials, autogenous bone.

INTRODUCTION

Rehabilitation of edentulous sites with implant-supported restorations is a reliable technique with a predictable outcome. Alveolar ridge resorption after tooth loss is very common and may compromise the placement of implants. Trauma, oncologic diseases, oral infections, and congenitally missing teeth may also cause severe bone deficiency. A wide range of surgical procedures, such as guided bone regeneration (GBR) through the use of resorbable and non-resorbable membranes, intra- and extra-oral block grafting, and distraction osteogenesis, can be applied for reconstruction of alveolar ridge deficiencies [1–3]. Defect morphology plays an important role in the success of alveolar ridge augmentation techniques. Defects can basically be classified as intrabony or extrabony defects [4]. .It is easier to maintain space, stabilize the augmented site, achieve primary soft tissue closure, and protect the grafting site in intrabony defects than in extrabony defects. Therefore, intrabony defects are much easier to augment through techniques such as socket augmentation and sinus floor elevation. Extrabony defects can be more challenging in cases such as lateral and vertical augmentations (Figure 1) [5].The amount of augmentation may also influence the risk assessment of the operation. Particularly for vertical augmentation, complications are more likely if a large amount of height is needed outside the natural bone after bone regeneration.This article is focused on GBR and extra-oral bone block techniques that are widely used for ridge augmentation.

Guided Bone Regeneration (GBR)

GBR is a surgical technique that increases the amount of alveolar ridge for implant placement using barrier membranes with or without bone substitutes [4]. Regeneration at the deficient site depends on the exclusion of soft tissue (epithelial cells and fibroblasts) from osteogenic tissue (osteoblasts) during organization of the bone [6]. Osteoblasts are mainly responsible for increasing the amount of regenerated alveolar ridge. However, osteoblasts do not regenerate the alveolar ridge as quickly as epithelial and connective tissue cells grow. The success of the GBR approach mainly depends on the exclusion of soft tissue cells during bone remodeling by slowly working osteoblasts [6]. Aghaloo et al. evaluated the success of ridge augmentation techniques (GBR, onlay block grafting, distraction osteogenesis, ridge splitting, and mandibular interpositional grafting) based on implant survival in a systematic review [7]. They found that GBR may be the best way to augment the ridge according to implant survival.The GBR technique can be applied in two stages (delayed approach) or in one stage (simultaneous approach with implant placement). If the bone deficiency is low and implant stability can be achieved, the one-stage approach can be applied (Figure 2).

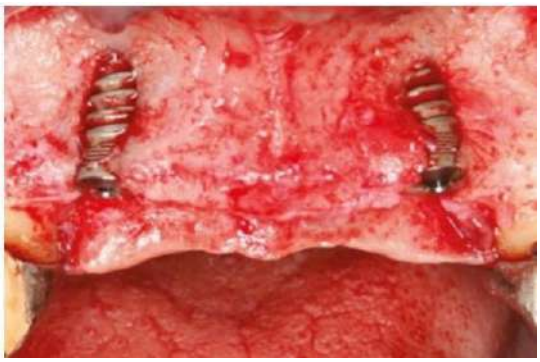

Figure. 2
However ,if a greater amount of bone must be regenerated ,then the two stages approach is preferable and the complication risk will be reduced.The predictability of GBR is based on several principles ,such as space maintenance ,stability ,nutrition and primary closure.

Space Maintenance

Maintenance of space at the augmented site is one of the fundamental principles of the GBR technique. A protected space is needed for hard-tissue cells to regenerate bone that excludes soft-tissue cells during healing and maturation.Bone substitutes, membranes, tenting screws, titanium, and bone plates are suggested for the maintenance of space. Jovanovic et al. evaluated the treatment groups in a pre-clinical study on GBR. They found that significant bone gain could be achieved when membrane and graft material were used than when no membrane was used [8] . Space maintenance can be challenging depending on the properties of the defect site. When significant bone augmentation is required in a severely resorbed alveolar ridge, creating space is more critical for the success of GBR.

Grafting Biomaterial

Currently, the use of a bone substitute material in GBR applications is the standard of care. The primary types of bone substitutes are autogenous bone, xenografts, allografts, and alloplasts [4] . An ideal biomaterial for bone regeneration should have the ability to form new bone, and bone formation must be balanced with the speed of resorption [4, 6] . Autogenous bone is the gold standard for augmentation because of its osteogenic potential. It has the ability to regenerate bone through the mechanisms of osteogenesis, osteoinduction, and osteoconduction [4, 6] . Osteogenesis is the production and evolution of bone at every site, even in the absence of local undifferentiated mesenchymal stem cells. Osteoinduction is the transformation of undifferentiated mesenchymal cells into pre-osteoblasts and osteoblasts. Therefore, the graft material should be in contact with living bone. Osteoconduction provides a non-living scaffold for the regeneration of bone [9.] By using local bone harvesting techniques, morbidity can be lowered during autogenous bone collection. Scraping autogenous bone from a location near the recipient site may simplify bone harvesting, decrease morbidity, and reduce the treatment time (Figure 3).

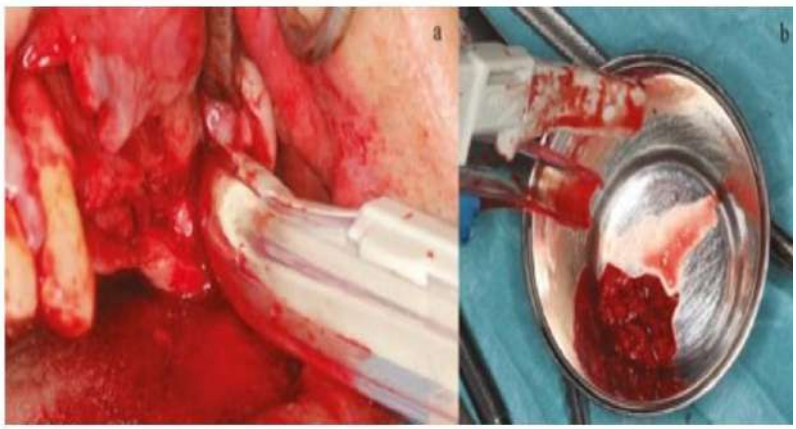

Figure 3
Bone harvesting from tuber site.

Peleg et al. found that the use of a bone scraper to harvest autogenous bone at the ramus resulted in no neurosensory injuries to the anatomical tissues and minimal morbidity in the patients [10] .There are also novel rotary tools to harvest bone easily from local sites (Figure 4).

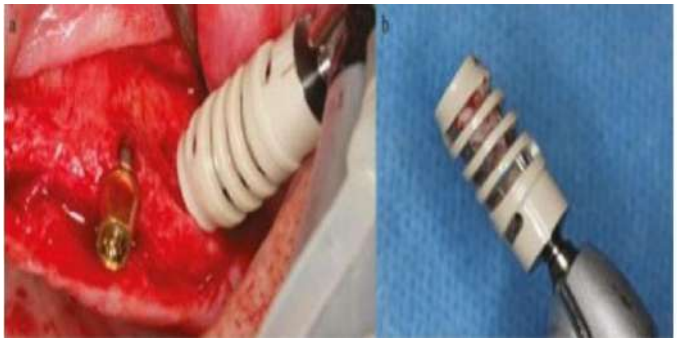

Figure 4
Bone harvesting rotary instrument.

These autogenous particulate grafts can be used alone or with biomaterials as a composite. Composite grafts greatly reduce the amount of autogenous bone required and therefore reduce morbidity.Bone graft substitutes have osteoconductive properties. However, the use of bone grafting material is very popular among clinicians because of benefits such as the unlimited availability, lack of a need to harvest bone (hence, reduced donor-site morbidity), reduced operation time, and reduced risk of postoperative complications [4, 6].Xenografts are bone grafts obtained from animals such as cows, horses, or species other than human [4, 6]. Deproteinized bovine bone (DBB) is a xenograft material that is frequently used in GBR applications. DBB is osteoconductive and has an interconnecting pore system that serves as a scaffold for the migration of osteogenic cells; the inorganic bone substance has a microscopic structure similar to that of natural cancellous bone [11, 12]. DBB particles are incorporated over time within the living bone, and DBB resorbs very slowly and has lowsubstitution rates. Therefore, it can provide space maintenance over a very long term [4, 6.] .It was shown that DBB graft particles remain present even after 10 years postoperatively [13]. Chackartchi et al. reported that the mean percentage of new bone was 28 ± 6% using DBB alone 6–9 months after sinus augmentation [14]. Materials with low-substitution rates are good scaffolds for host bone growth during healing, and they inhibit resorption of the augmented site [4, 6]. However, increased amounts of residual graft particles may negatively impact the healing of the augmented site and decrease the rate at which the implant surface area is integrated with the newly formed bone [15]. In challenging cases that require a greater amount of bone augmentation, such as vertical, horizontal, or both, DBB can be mixed with autogenous particulate bone and applied as a composite [2]. The authors recommend allowing 6–9 months for healing of lateral/vertical augmentations before implant placement. During long-term healing, DBB particles prevent the shrinkage of the augmented site, and autogenous particles facilitate the incorporation of this scaffold with the living natural bone. The authors do not recommend implant placement during the early stages of bone healing (less than 4–5 months) for two-stage augmentations because implant stability may be compromised or severe marginal bone loss may occur before loading [4, 6].Allografts are bone grafts obtained from the same species but are genetically dissimilar from the recipient [4, 6] .Allograft donors are meticulously screened, and specimens are carefully processed to reduce the possibility of disease transmission. Freeze drying is a commonly used process. Mineralized allografts (MAs) provide stability and space by maintaining their physical properties during the bone remodeling phase [4, 6]. Osteoconductive scaffolds provide volume enhancement and effective site management for successful dental implant placement after augmentation [16.] MAs can be composed of cortical and cancellous particles. Mineralized cortical particles with slow resorption rates offer a scaffold, whereas cancellous particles that have faster resorption rates and are prone to resorption may provide a space for the ingrowth of bone cells and angiogenesis. Therefore, if the amount of cortical graft particles is increased in the composite, less resorption can be expected [17]. Demineralized allograft (DA) contains bone morphogenic proteins and stimulates osteoinduction. However, DA is highly biodegradable and has less compressive strength than DBB and MA. Therefore, it is often mixed with other slowly resorbed graft materials to maintain space . The authors recommend using MAs in challenging cases, and demineralized grafts are recommended in well-protected defects such as socket augmentation. Implants can be placed safely after 4 months of healing in well-protected defects . The authors do not recommend using DA in challenging cases, such as vertical and lateral augmentation, because a great amount of bone loss can be expected after long-term healing [12].The possibility of disease transmission from xenografts and allografts to humans has drawn attention to synthetic bone graft substitutes . Alloplasts are synthetic and also have osteoconductive properties that provide a scaffold for bone regeneration . Various synthetic graft materials have been developed for crestal ridge augmentations, such as synthetic hydroxyapatite (HA), beta-tricalcium phosphate (β-TCP), and calcium sulfate (CS) [4]. HA has a low or very limited resorption rate [4]. β-TCP and CS are highly biodegradable and have less compressive strength than synthetic HA and DBB [21, 22]. CS can be completely resorbed within 1 month . Therefore, according to the defect properties, these materials can be mixed with slow resorbable materials in different ratios to maintain space during healing [21, 22]. By increasing the amount of resorbable material in the composite, the rate of new bone formation can also be increased. However, the space maintenance capacity will be reduced, even in sinus augmentation applications [24].The particle size in the graft may also affect the resorption time and the success of the procedure. There are conflicting articles in the literature regarding graft particle usage [14, 25]. Particles that are too small may be resorbed too rapidly, and advanced shrinkage of the augmented site can be observed. Particles that are too large may prevent angiogenesis and delay and/or reduce new bone formation [25]. Chackartchi et al. compared the use of small and large particles in grafts during two-stage sinus floor augmentation with regard to new bone formation and vertical bone height stability. The authors could not detect any statistically significant differences between the small and large graft particles [14].Several factors, such as the graft properties, membrane choice, surgical technique, use of compression during packing of the

graft material, availability of natural bone, composition of the graft, and activity of the host bone, may influence the resorption rate at the augmented site and may therefore affect space maintenance [26].

Barrier membranes

Barrier membranes are routinely used to maintain space. There are two kinds of barrier membranes: resorbable and non-resorbable [4, 6].

Resorbable membranes

The most important advantages of resorbable membranes are the elimination of membrane removal after healing, resulting in decreased morbidity, easy manipulation, and lower rate of complications. However, resorbable membranes are not very successful in comparison with non-resorbable membranes with regard to space maintenance. These membranes must be used with bone graft substitutes and additional tools, such as tenting screws or plates for space maintenance.Resorbable membranes that are made of native collagen (non-cross-linking) show high biocompatibility resulting in good tissue integration and rapid vascularization (Figure 5) .

Figure 5
Native collagen resorbable membrane.

However, these membranes may lose their barrier function early due to rapid biodegradation . The resorption time depends on the membrane's properties, the cellular activity of the native bone, and exposure [29]. One of the most important benefits of non-crosslinked collagen membranes is the spontaneous closure of membrane exposure during the healing period . Epithelization of the exposed membrane occurs within weeks after mucosal dehiscence. Although spontaneous healing of the exposure occurs, the grafting volume may be negatively affected during healing, and some bone loss may be expected [4, 6.] Simion et al. compared the effects of exposed and non-exposed membranes on bone regeneration at the site of implant insertion . Bone regeneration was 99.6% with nonexposed membranes and 48.6% with exposed membranes . There are also studies showing predictable results with late membrane exposures up to 6 months [5]. Therefore, every effort should be made to ensure primary closure of the grafted site during healing. Some clinicians recommend using double non-cross-linked membrane over the grafted site to extend the resorption time for better barrier function [6].Cross-linking resorbable collagen membranes were produced to extend the degradation time in GBR applications. In a preclinical study, different collagen membranes were compared to evaluate the resorption time . It was found that if the amount of cross-linking collagen fibrils was increased, the resorption time was also extended. However, tissue biocompatibility was decreased. There are also studies showing good results regarding tissue integration and bone regeneration using these membranes . Various types of cross-linked membranes may affect biocompatibility and tissue integration differently [6]. Membranes made of polylactic acid/polyglycolic acid copolymer (PGLA) are also available. These synthetic membranes simplify the clinical manipulation and reduce the application time [6]. Although studies have shown that this material is highly biocompatible and degrades without acidic products, concerns about the healing mechanism remain (Figure 6)

Non-resorbable membranes

When a higher amount of bone augmentation is required, reinforced non-resorbable membranes are used. Reinforced membranes withstand the pressure from the surrounding tissues, resulting in the prevention of membrane collapse and allowing the bone to be regenerated during healing. Titanium mesh, titanium-reinforced expanded polytetrafluoroethylene (e-PTFE), and dense polytetrafluoroethylene (d-PTFE) membranes are most commonly used, and their benefits have been demonstrated in published studies [2, 4, 6]. Urban et al. augmented alveolar ridges vertically using e-PTFE membranes . The mean vertical augmentation was 5.5 mm after 6–9 months of healing. They concluded that vertical augmentation with e-PTFE membranes and particulate autografts are a reliable method for the reconstruction of deficient alveolar ridges.Currently, e-PTFE membranes are not used in oral surgery due to high rates of complications related to membrane exposure. d-PTFE membranes are novel titanium-reinforced nonresorbable membranes that have replaced e-PTFE membranes and are used for the reconstruction of critical-sized defects, such as sites requiring vertical augmentation. The highly porous structure of e-PTFE membranes allows ingrowth of the oral microflora when the membrane is exposed. Exposure results in high rates of infection, regardless of whether it occurs early or late during healing. Due to the high porosity of the membrane, it is almost impossible to mechanically or chemically clean the exposed site of the membrane; therefore, early removal of the membrane is required. After removal, it is generally discovered that GBR has failed due to infection, and re-augmentation is needed. e-PTFE membranes must be completely healed in primary closure, and they have no tolerance for exposure [4, 6].Novel d-PTFE membranes are manufactured in a dense micro-porous form that prevents oral bacteria from entering the grafted site when exposed. These membranes are also easy to mechanically and chemically clean. The removal of a d-PTFE membrane after healing is also easy to perform and takes less time than the removal of titanium-mesh membranes (Figure 7).

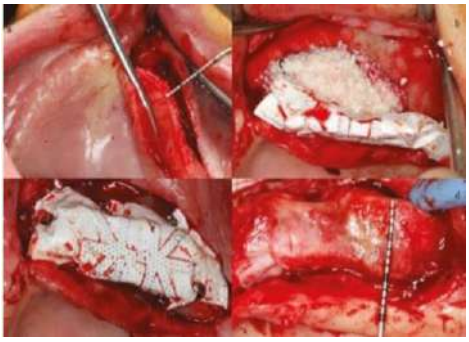

Figure 7
Titanium reinforced non-resorbable membrane.

Ronda et al. reported a mean defect fill of 5.49 mm after 6 months of healing at vertically augmented sites using d-PTFE membranes . Urban et al. observed an average bone gain of 5.45 mm using d-PTFE membrane with a mixture of bovine bone and autogenous particulate bone [2]. They also found a high rate of new bone formation (36.6%) on core biopsies that were taken at the time of implant placement. They concluded that treatment of vertically deficient alveolar ridges with GBR using a mixture of particulate autogenous bone and bovine grafts with d-PTFE membrane is a reliable method.Although a high level of success with non-resorbable titanium-reinforced d-PTFE membranes has been reported in the literature, these membranes must be applied cautiously in selected patients. Non-resorbable membranes have higher complication rates than resorbable membranes . If a d-PTFE membrane begins to be exposed, the amount of exposure can increase incrementally during healing [5]. Therefore, if early exposure of this membrane occurs, the prognosis may not be predictable. However, late exposures may be better tolerated with meticulous mechanical cleaning. If an infection does not occur 3–4 months after grafting, removal of the membrane may preserve the regenerated bone [5]. Complications regarding membrane exposure are less likely with resorbable membranes. The cost of GBR with titanium reinforced membranes may also be higher than with resorbable membranes. Jensen et al. reported comparable amounts of bone gain between resorbable and non-resorbable membranes used for horizontal augmentation [15]. If minor augmentation is planned at a deficient site, resorbable collagen membranes should be considered first due to their low risk of complications. If the natural bone is not too thin, lateral augmentation can be successfully performed using collagen membranes with mixed autogenous particulate grafts and lowsubstitute graft materials such as DBB.Titanium mesh is another alternative to non-resorbable membranes, and this type of mesh has a good space maintenance advantage . It can be easily trimmed and bent according to the defect site. Another advantage, and also a disadvantage, of mesh over a PTFE membrane is that the holes within the membrane allow vascularization and nutrition from the periosteum to the grafting site [4–6]. However, bone can also grow from inside these holes over the mesh. After healing, the mesh can integrate with newly formed bone and complicate removal during surgery at the second stage.

Stability

The stability of the augmented site in GBR applications during healing is an important factor for achieving success. The initial blood clot formation and stabilization of graft particles will result in predictable bone formation [5]. Although barrier membranes will cover the augmented site and exclude epithelial and connective tissue cells from the regenerating bone, additional tools are needed to provide stability and also to increase the resistance of the augmented site from the flap, lip, and mastication force pressure [5].Membrane fixation systems can be used to secure resorbable membranes effectively. By using manual or

automatic handles, tacks stabilize the membrane to the natural bone and prevent migration of the graft and soft tissue invasion (Figure 8).

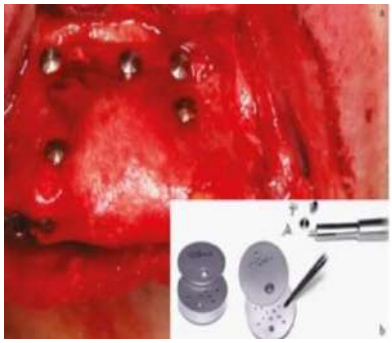

Figure 8
Bone tacks.

Another advantage is that tacking membranes simplify suturing because the membrane does not move during suturing. If lingual or palatal tacking is needed, the angled neck of the handle can be used to simplify the application. Generally, the tacks are made of titanium, and they do not need to be removed at the second-stage surgery. The authors recommend removing tacks that are placed coronally and leaving apically positioned ones to reduce morbidity from excessive flap elevation at the time of implant placement. If tacks are left, they may disturb the patient in the future, and they can be easily removed using a small circular incision around the tack.Tacks may not be strong enough to secure non-resorbable membranes. Generally, membrane fixation screws are used for stabilization. The aggressive tip and thread design engage the membrane and bone and allow for precise placement in soft and dense bone (Figure 9).

Figure 9
Bone screws.

The authors recommend using short screws in the mandible and longer screws in the maxilla due to its low density; it is easier to engage longer screws in soft bone. If lingual or palatal screwing is needed, surgical hand pieces can be used to simplify the application. At the second surgery, the non-resorbable membrane and all screws must be removed. If any screw is left, the membrane may not be removed easily.Tenting screws can also be used under resorbable or non-resorbable membrane to prevent pressure from the environment and also to stabilize the augmented site. The treaded part of these screws engages the natural bone, and the smooth part remains at the augmented site (Figure 10).

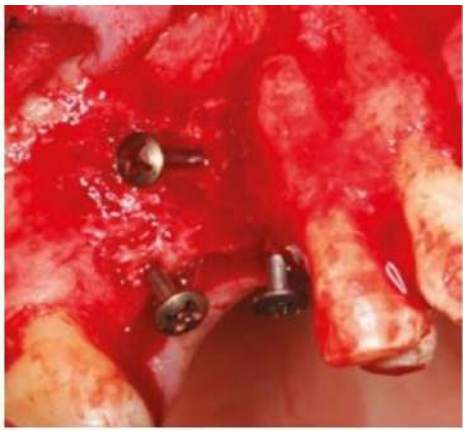

Figure 10
Tenting screws.

Another advantage of using tenting screw is that the clinician may estimate the amount of future bone gain at the time of the operation based on the length of the smooth part. For example, if 5 mm of bone gain is needed, an 8-mm tenting screw can be used and 3 mm of bone will stabilize the screw.Metal plates that are generally used for orthognathic or trauma surgery can be used for space maintenance [4, 6]. The plate is fixed to the natural bone with screws, and the space between the bone and plate is filled with graft material. A resorbable membrane covers the augmented site. The authors recommend avoiding the use of overly thick plates to prevent soft tissue exposure during healing. Thin cortical strut allografts can also be used for space maintenance in a method known as the Shell technique. Space is created between the cortical strut and the host bone as with metal plates, but there is no need to remove the cortical struts during the second-stage surgery. However, these bone struts are very vulnerable during screwing, and they can be easily broken into pieces [4, 6].

CONCLUSION

Many novel techniques, biomaterials, and tools have been described in the literature that clinicians may use to reconstruct bone deficiencies. However, most importantly, the success of alveolar ridge augmentation procedures mainly depends on clinician experience and skill. The surgical risks may be increased for challenging reconstructions. Therefore, the clinician and patient should carefully evaluate the benefits and risks of the operation and decide on the most ideal treatment option. Prosthetic-driven augmentation is recommended for a better outcome. If the clinician focuses only on ridge augmentation techniques to solve bone deficiency problems, he or she may overlook other treatment options that may have lower risks and less morbidity, such as using short, narrow, or tilted implants. After all, ridge augmentation is being performed for the ideal placement of dental implants.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-24

Implant Fracture: A Review Article

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Abstract: Dental implants have become a revolutionary means of rehabilitation for edentulous and partially edentulous patients, and successful integration of has been well documented for patients with those clinical conditions. Since the rate of success in edentulous case has been high, the concept of osseointegration has become a predictable treatment modality [2]. Yet this now gold standard treatment modality is not without its own set of adversities. Implant failures are almost as common as implant success. The types of implant failures are 1) loss of integration, 2) positional failures 3) soft tissue defects, and 4) biomechanical failures. In this article we shall delve deeper into the failure due to implant fracture aspect.

Keywords: Dental implant, screw breakage, implant fatigue, biomechanical failure of dental implants, dental implant failure. Dental implant fate, fatigue of dental prosthesis, stress induced fatigue in implants.

INTRODUCTION

Within the past few decades dental implants have progressed a lot from being the implants used and studied by Dr. P. Brånemark in 1978. He was the 1st person to observe and thus describe the concept of osseointegration, although the true credit of 1st ever dental implant to be used in recorded human history goes to the ancient Mayan civilization in 600AD, where they successfully implanted pieces of shell as replacement for mandibular teeth. Scores of physicians, scientists and dentists have over the centuries helped to make dental implantology as it is today, a very reliable rehabilitation method for edentulous spaces in both the maxilla and mandible. Implants vary immensely according to the shape as well as the composition as well as with an internal hex or external hex design. Modern implants that are commonly used are mostly root form and are generally torqued into place after the drilling has been done into the bone. The steps involved in implant placement are: (1) proper treatment planning and selection of implant dimensions for the tooth to be replaced, using radiographic interpretation of dimensions and density of the alveolar bone with clinical correlation. CB-CT is considered to be gold standard. (2) Surgical phase, where first a surgical guide is placed, pilot drill is then used with a slow rotation physio-dispenser to drill up to the required depth which is equal to length of implant. The consequent drills of increasing diameter are used to reach desired diameter. The implant is then tightened into place using a torque wrench and a Hex. The maximum torque recommended for root form implants is 75 Nm. The sweet spot is around 30 Nm. The healing cap is then screwed in. Then the surgical site is closed and hence commences the healing phase. The healing phases is generally 3 months for mandible and 6 months for maxilla. This enables oseointegration to happen. (3) Prosthetic phase, where the site is opened up, over lying bone is removed if necessary, the healing cap is removed and an abutment is screwed in and impression is taken for cast pouring. Then, the prosthesis is fabricated and fixed on the abutment.Yet this golden standard of rehabilitation for edentulous spaces, although so refined, has immense potential for failures as well. As many cases fail as the number of successful cases. Research over the years have shown that the major causes of implant failure are (a) deficient osseointegration, (b) complication of the neighboring soft tissues (peri-mucositis and periimplantitis) and (c) mechanical complications. Among the biomechanical problems, screw loosening, abutment rotation, and abutment fracture are the major issues [2]. We shall now go into more details about abutment fractures and the physical factors that resist as well as cause it.

DISCUSSION

Micro Metal fatigue of restorative materials can lead to breakage — the rigid connection of implants bone demands that attention is paid to the size of connectors[1]. Fracture of implants and implant components can happen often and this is due to improper treatment planning and excessive forces being exerted on the implants. Example of an improper treatment plan is- a single implant in an incomplete dentition and a terminal tooth, the implant being connected to the tooth causing decay on the tooth, and eventually the implant to fracture under the load. Most of the materials used to restore implants are derived from conventional restorative dentistry, for example denture base resins. Complete denture wearers develop relatively little bite force compared to force generated with implant supported restorations. Breakage is a common failure of overdenture restorations.Youssef S. Al Jabbari, Raymond Fournelle, et al [8] published a study in 2007, where they performed a failure analysis on fractured prosthetic retaining screws after long-term in vivo use. The study also addresses the commonly asked question regarding whether complex repeated functional occlusal forces initiate fatigue-type cracks in prosthetic retaining screws. They did the study on ten fractured implants from 3 patients. In two patients, the middle three retaining screws of the prostheses were found fractured at the time of retrieval. They were in service for 20 and 19 months, respectively. In the last patient, the middle three retaining screws and one of the posterior retaining screws were fractured at the time of retrieval after they had been in use for 18 months. Low power stereomicroscopy and high-power scanning electron microscopy (SEM) were done to analyze the fractured surfaces of the retaining screws to examine fatigue cracks in greater detail.Roman M. Cibirka, Steven K. Nelson, et al d [7] id a study to examine potential differences in detorque values of abutment screws after

fatigue testing when the dimensions between external implant hexagon and internal abutment hexagon were altered or the implant external hexagonal shape was eliminated. Ten NobelBiocare implants were divided into 3 groups and assessed: (1) standard external hexagon (R), (2) modified hexagon (M), and (3) circular (C) platform geometry. Thirty Procera machined abutments with 25-degree angulated loading platforms were manufactured. Abutments were retained with gold Unigrip abutment screws tightened to 32 N/cm with an electronic torque controller. Vertical scribes across the implant–abutment interface allowed longitudinal displacement evaluation. A carousel-type fatigue testing device delivered dynamic loading forces between 20 and 200 N for 5,000,000 cycles, or the approximate equivalent of 5 years in vivo mastication, through a piston to the abutment platform. Macroscopic and radiographic examination of the implant/abutment specimens was performed. The abutment screws were removed and the detorque values recorded. Bearing surfaces were examined microscopically. No abutment looseness or longitudinal displacements at the implant–abutment interface was noted. Radiographic examination demonstrated no indication of screw bending or displacement. The mean detorque values for R, M, and C were 14.40 ± 1.84 N/cm, 14.70 ± 1.89 N/cm, and 16.40 ± 2.17 N/cm, respectively. They concluded that Increasing the vertical height, or degree of fit tolerance, between the implant external hexagon and the abutment internal hexagon or completely eliminating the implant external hexagon did not produce a significant effect on the detorque values of the abutment screws after 5,000,000 cycles in fatigue testing, or the equivalent of 5 years' of mastication for the implant/abutment specimens evaluated. All of the middle three retaining screws from each group and one of the two posterior screws were fractured with moderate to severe thread wear. All the fractured screws showed rachet mark defect on the fracture surfaces, which Shows typical fatigue failure. SEM examination revealed all three classical stages of fatigue failure, and it was possible to see the ratchet marks on the fracture surfaces of all specimens, indicating a fatigue zone. The final catastrophic overload fracture appeared fibrous, indicating ductile fracture. The final overload ductile fracture surfaces showed equiaxed dimples, suggesting tensile overload in all examined screws except in two specimens that showed an elongated dimple pattern indicating shear/tearing overload forces. They thus concluded that Fracture of prosthetic retaining screws in hybrid prostheses occurs mainly through a typical fatigue mode involving mostly the middle anterior three screws. Fatigue cracks can grow in more than one prosthetic retaining screw, leading to fracture before the patient or clinician determines that any problem exists. In 2015, Sun-Young Lee, Sung-Jun Kim, Hyun-Wook An, *et al* from Institute of Science & Technology, Megagen Implant, Gyeongsan, Republic of Korea Department of Periodontology, School of Dentistry, Kyungpook National University, Daegu, Republic of Korea MIR Dental Hospital, Daegu, Republic of Korea conducted a study to determine the effect on mechanical properties due to thread depth of various lengths of dental implants.The researchers used Commercial Titanium implants of various lengths, diameters and thread depths and Solid rigid polyurethane blocks with uniformity as an alternative to human cancellous bone. The implants were tightened with a recommended torque of 30 Ncm using a digital torque meter. [3] The Titanium implants were tightened with the EZ Post containing the hemispherical loading members were fixed with a specimen holder that was made from brass and clamped in the jig of a universal test machine [3]. After the static compressive strength tests, the Titanium implants were examined macroscopically. The failure mode was observed to be deformation in the abutment and being torn horizontally at the upper side of the Titanium implant. The threads in the Titanium implants with deeper threads did not show breakage. Titanium implants with the same length and inner diameter have a similar maximum compressive strength. The mechanical strength is more related to the length and diameter than the thread depth. The failure mode was observed in the fixtures and abutments but not the threads. The thread depth did not have a major effect on the mechanical strength. Titanium implants with deeper threads did not induce the breakage of threads applying the maximum compressive strength. Dental implants may fracture at load levels below the maximum compressive strength of the implant/abutment complex. Thus, the maximum compressive strength may suggest a standard point of acute overload. Mechanical failures of dental implants appear through a repeated loading process at low loads. The fatigue test is a general method used in the laboratory to mimic actual intraoral use. The fatigue limits of the dental implants with a diameter of 4.0 mm and thread depth of 0.6 mm (636 N) and those with a diameter of 4.0 mm and thread depth of 0.35 mm (619 N) in the fatigue test on the basis of the International Organization for Standardization (ISO14801) were both more than 600 N. The fatigue limit of the Ti implants with deeper threads is similar to that of Ti implants with shallow thread depth. The study indicated that the Ti implants with the deeper threads have similar mechanical stability [3]. In 2009, Cleide Gisele RIBEIRO, Maria Luiza Cabral MAIA, Susanne S. SCHERRER, *et al* from Brazil conducted a study on the fatigue resistance of dental implants based on the design of abutment-implant interface. This study demonstrated the superior fatigue resistance of external hex interface. There was no significant difference between the conical and internal hex interfaces. Probably, the quality of the surface machining of the flat-to-flat mating surfaces (mainly, the machining accuracy of the screw and thread) determined the superior resistance of the connector; The mode and region of fracture in prosthetic screws observed in this study suggested that failure of these screws occurred by fatigue (presence of fatigue striations) and involved the threaded part [2]. Ana I. Nicolas-Silvente, Eugenio Velasco-Ortega, et al [6] did a study, where fifty-four titanium dental implants from three different implant systems were compared in this study. The characteristics of each implant group are summarized: - Group I (n = 19): Surgimplant CE: titanium grade 5 dental implant with hexagon external connection (platform: 3.5 mm, length: 12 mm) (Galimplant SLU, Sarria, Lugo, Spain) - Group II (n = 18): Surgimplant CI Double Hexagon: titanium grade 5 dental implant with double hexagon internal connection (platform: 3.5 mm, length: 12 mm) (Galimplant SLU, Sarria, Lugo, Spain) - Group III (n = 17): Surgimplant CI Octagonal: titanium grade 5 dental implant with octagonal internal connection (platform: 4.0 mm, length: 12 mm) (Galimplant SLU, Sarria, Lugo, Spain). A fatigue test was performed to obtain the number of cycles before fracture. The maximum and minimum force applied was recorded for each sample. The assays were performed with a servo-hydraulic testing machine (MTS 858 Mini Bionix II, MTS, Minneapolis, MN, USA) equipped with a load cell MTS 661.19F-01 of 5 kN. The implants were fixed 30 angulated with the axis z of the load cell. Maximum loading applied to the implant was around 80% of the value of the implant failure load, obtained by a static test under the same geometric conditions as fatigue tests, following ISO 14801:2008 recommendations. All tests were carried out under stable environmental conditions with a temperature of 25 C and relative humidity of 60%. The failure mode was similar in all experimental groups, including large deformations at the implant neck area. The implant neck fracture took place most of

the cases between the first and second threads. The authors concluded that the platform diameter a ects the fatigue load limit, obtaining a lower fatigue load limit implants with the narrow platform (3.5 mm) than the regular platform (4 mm). On the other hand, the indexation design may interfere with the width of the implant walls, especially in narrow implants, making internal connections more unstable at this level. It would be advisable to develop long-term clinical studies to assess the restoration's success rate and survival. Thus, implants are not without such chance of failure. Studies conducted has yielded results that around 10% of implants result in failure. Out of that around 2% is due to implant fracture. Implant fracture generally occurs due to faulty manufacturing, improper abutment, due to trauma from occlusion due to improper height or due to patient related cause such as biting an extremely hard object like walnut or very hard bone. Out of all these manufacturing defects is of the least incidence. Patient induced fracture is the most common.

CONCLUSION

SO, we can now conclude that even though implants are considered the gold standard now, failures are pretty common and the possibility of an implant fracture is dependent on a multitude of various factors such as technique, material, design and the peri-implant environment as well. Since titanium implants are so very much biocompatible, they can be left as it is, without any complications, if a fracture does occur and it is not feasible to remove the fractured implant.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-25

Principles Of Panfacial Trauma – A Review

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Abstract: Traumatic panfacial fracture fixation is one of the most complex reconstructive surgical procedures. There are many principles in the literature regarding the repair of panfacial injuries in a stepwise manner. The primary goal in management of these approaches is to achieve the occlusal relationship, so that other regions align eventually. Through proper occlusion, the mandibular-maxillary region with the skull base, the spatial relationships and stability of midface buttresses and pillars with time can be re-achieved. Such injuries seem difficult at the beginning, but if a proper stepwise method is followed with needful understanding of the principles of fixation, the outcomes are optimized. There are different mechanisms through which injury occurs which is along the zones of weakness within the midface and mandible shows a common fracture pattern. The Standard fracture patterns are classified by LeFort. Still generally, there is a combination of various components of the LeFort fractures and other fractures. The components of the ideal panfacial fracture involve the lower third, the middle third, and upper third of the face, but the involvement of the midface and mandible constitute the same principles of repair, as a true panfacial fracture would have.

Keywords: panfacial fracture, facial trauma, occlusion Achieving occlusion, spatial relationships of maxillary region(midface) and mandible, Noe complex , Mid face trauma , Nasal bone fracture.

INTRODUCTION

Determining the complexity of the Pan facial trauma can be a great challenge to the operating Maxillofacial Surgeon. When divided into small parts, each fracture is described as reparable. When most of the facial structure is fractured, it is very much difficult to re-structure the original three-dimensional shape and to properly reposition the fractured fragments. Practically, that reconstruction should be performed from the known to the unknown, which might also be taken as operating from the stable to the unstable structures. In fact, first occlusion should be achieved. The reconstruction actually is established from the periphery towards the center. Using the available approaches, the more solid cranial areas are to be repaired first which will help in establishing the template for repositioning the zygomas. The facial height can be reestablished by completing the reconstruction of the mandible. So, the mandibular teeth and arch can serve as a template for the re-establishing occlusion with the maxillary dental arches. Tooth loss and communited fractures may require the use of surgical splints and guides, and the surgeon should also not hesitate to apply it. In panfacial trauma, the reduction of sub-condylar fractures—particularly bilateral subcondylar fractures—becomes an major component in the repair, because the mandibular ramus height is a critical guide to the overall facial height. The maxilla can then be stabilized to the reposition the zygoma above and to the dentition below. Once the maxilla is repositioned and reconstructed, attention then can be turned to the central face which is the nose and NOE complex region (NOE fractures). Finally, after the facial architecture has been reestablished, the orbital walls are reconstituted. If this has been performed successfully, a postoperative CT scan should confirm a reasonably normal facial skeletal architecture.

These are all the type of fractures which can occur in the upper and middle third of the face.

- Le Fort I
- Le Fort II
- Le Fort III
- Frontal sinus
- Nasal
- Bilateral NOE
- Bilateral zygoma
- Bilateral orbit including the medial and lateral wall, and orbital floor and roof
- Simple sagittal split of the palate

DISCUSSION

The primary and the most important goal is to restore the alignment in all three dimensions, fixation of the plate to the maxillofacial buttresses wherever required. One of the major advancements in the diagnosis of pan facial fractures is recent developments in 3-D imaging, mainly in CT and cone beam technology. This helps in the assessment of injuries and is a prerequisite for proper diagnosis, planning, reduction, and outcome. Radiographic diagnosis need not to be restricted to the 3-D views since multiplanar 2-D view may show critical features not seen in the 3-D views. Also using of an intraoperative model or skull greatly helps in contouring of hardware and facilitates proper skeletal reconstruction Sequencing of the surgery:

1. Re-establish the maxillo-mandibular unit as the first major step of theg (bottom-up).
2. Starting with the reduction and fixation at the level of the calvarium and working in a caudal direction (top-down).
3. Also, care should be taken that with this second option of sequencing, re-establishment of the proper maxillomandibular stability is very important, but may be achieved later in the stages.

Reestablishing the maxillo-mandibular stability and occlusion should always be the first priority. In a Le Fort type fracture with no sagittal split palate without mandibular fracture, reestablishment of the occlusion can be done just by using arch bars and IMF (closed reduction). In a Le Fort type fracture where there is a sagittal split of the palate but no mandibular fracture, then the mandibular arch can be used as a guide in achieving the occlusion of the maxillary arch with placement of arch bars and IMF. The recommended sequence for this portion of the treatment of the palate is dependent on whether it is a simple or complex (comminuted) palatal fracture. If there is a Le Fort type fracture and a sagittal split of the palate together with mandibular fractures, reestablishment of the proper width of the disrupted dental arches is more difficult. The surgeon must reconstruct one dental arch and use it as a template for the other. This can be done one of two ways. The first being anatomic reduction and the second using model surgery and fabrication of splints on dental casts. In the illustration, the mandible was anatomically reconstructed and used to restore the width of the maxilla through the use of MMF (first option). The second option involves taking dental impressions, making dental models, and from these models, performing model surgery to examine and reestablish the premorbid occlusion. In these complex cases, cuts need to be made in the maxillary portion and the mandibular portion of the dental models to recreate the fractures to determine the premorbid occlusion and contour of the maxillary and mandibular arches.Once the maxillary and mandibular model surgery has been performed, palatal and/or mandibular splints are fabricated for use during surgery. This technique may also be considered in any case where either the palatal fracture or mandibular fracture is very complicated but the other portion of the maxillomandibular unit is intact. The surgeon may choose to use dental impressions and models with any complex fracture involving the dentition where proper premorbid occlusion is uncertain. If a mandibular lingual splint is needed, it is fabricated and fixed to the mandible, also using arch bars and wires. In cases where there are condylar fractures, open treatment of these fractures will restore proper mandibular height and chin position.In this illustration the mandible was reduced and fixed and then used as a guide for the reduction of the palate.

CONCLUSION

In summary, the sequence of pan-facial trauma repair must be in a stepwise fashion. The restoration of the occlusion is the primary goal in the beginning of the sequencing process. The Le-Fort I level of the maxilla has to be restored in its width with IMF fixation. The unit is then restored to its vertical height and position in relation to the skull base. The remaining midface is then reconstructed by full exposure and reduction with the elements of repair involving restoration of the lateral wall of the orbit at the zygomatico-sphenoid junction and the projection of the zygomatic process of the temporal bone. The naso-orbito-ethmoid fractures are reduced at this point as well. After all of these fractures are addressed, then the LeFort I level can be plated because this is the area. Ultimately, panfacial fractures are managed through systematic sequencing steps focusing on the occlusion as the foundation for proper alignment.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-26

A Review Of Treatment Of Keratocystic Odontogenic Tumor: A Review Article

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Abstract: Philipsen in 1956 first described a cyst of the jaws lined by keratinizing epithelium. This was known as odontogenic keratocyst. It is now more appropriately named as Keratocystic Odontogenic Tumor(KCOT) because of it's tumor like behaviour. This article aims to throw light on the various treatment modalities of KCOT, along with an analysis of their success rates, as well as rates of recurrence, and morbidity. The goals of treatment should involve eliminating the potential for recurrence while minimizing the surgical morbidity. Enucleation followed by chemical cauterization using Carnoy's solution, followed by excision of overlying attached mucosa has been used for the successful treatment of KCOT. Marsupialization is also considered to be a successful method of treatment of smaller lesions. In this article, the clinical, radipgraphic and histopathologic features of KCOT are discussed, along with various treatment modalities including enucleation, marsupialization as well as resection. In the light of recent literature, it may be concluded that an aggressive treatment modality like enucleation with application of Carnoy's solution might be considered as the most appropriate treatment modality for the KCOT.

INTRODUCTION

Philipsen in 1956 first described a cyst of the jaws lined by keratinizing epithelium. This was known as odontogenic keratocyst, surgeons have been toiling to find an ideal treatment for it. The various options available for the treatment of the odontogenic keratocyst has been expanding over the past few decades. Despite this, the issue is still debateable in Oral and Maxillofacial surgery. Various treatment modalities have been employed for the successful treatment of the KCOT, from simple enucleation to resection.

Tumor Like Nature Of KCOT

KCOT behaves like a tumor in many ways:
1. Involvement of large areas of the bone
2. High recurrence rate
3. Distinctive histopathological features of the lesion
4. Disregulation of the PTCH (patched) gene in both Nevoid basal cell carcinoma syndrome associated and sporadic odontogenic keratocysts.

On the other hand, the successful treatment of KCOT by marsupialization essentially denies its tumor-like characteristics. However, cases of carcinoma arising in KCOT have been reported [1,2]. The recurrence of the lesion has even been reported in a bone graft [3]. In this article, we present a review of the various treatment modalities of KCOT.

Clinical Features

The lesion may occur at any age, from the very young to the elderly. However, it is extremely rare under the age of 10 years. The peak incidence is seen around the second and third decades of life. There is a male predilection seen. The mandible is more commonly affected than the maxilla, with majority cases occurring in the Ramus of the mandible, followed by the body. In the maxilla, the most commonly affected region is the third molar region, followed by the cuspid region. The lesions found in children are often reflective of multiple odontogenic keratocysts as a component of nevoid basal cell carcinoma syndrome, but not always.There are no characteristic clinical manifestations of the cyst, although about 50% of the patients are symptomatic prior to seeking treatment. Common features include pain, soft tissue swelling, and expansion of the bone. Drainage and various neurologic manifestations like lip or teeth parasthesia may be seen. In the maxillary lesions, there tends to be secondary infection due to it's vicinity to the maxillary sinus. Aspirated material from this cyst usually contains a cheesy material, suggestive of keratin; sometimes, the aspirated material may also contain a straw coloured fluid.

Radiographic features

Radiographically, KCOTs present as a unilocular radiolucency with a well defined peripheral rim. Scalloping of the border is also a frequent finding and this represents variations in the growth pattern of the cyst. Multilocular radiolucent KCOT is also observed but generally represents a central cavity having satellite cysts. Occasionally, the lesion may mimic a dentigerous cyst

and contain the crown of a retained tooth within its lumen. The gold standard for confirmation of a diagnosis is considered to be biopsy.

Histopathology

The wall of OKC is usually thin, unless there has been superimposed inflammation. The lining epithelium is highly characteristic, composing a parakeratinized surface which is typically corrugated, wrinkled or rippled. A remarkable uniformity of thickness of the epithelium, ranging from 6-10 cells thick. A prominent palisaded, polarized basal layer of cells, described as having a 'picket fence' or a 'tombstone' appearance. Histologically, these cysts are formed with stratified squamous epithelium that produces orthokeratin, parakeratin or both. The highly characteristic nature of KCOT is it's parakeratinized lining epithelium with surface corrugations and a palisaded basal layer. The epithelium is thin and mitotic activity is frequent. In cases where there is presence of an intense inflammatory process, the adjacent epithelium loses its keratinized surface, thickens and may develop rete ridges or ulcerate. The connective tissue wall often shows small islands of epithelium similar to the lining epithelium. The lumen of the keratocyst may be filled with a thin straw coloured fluid, or a thicker creamy material. Cholesterol, as well as hyaline bodies at the site of inflammation, may also be present. Dysplastic and neoplastic transformation of the lining epithelium is an uncommon occurrence but has been reported, careful microscopic examination must be done to rule out epidermoid carcinoma developing from a KCOT.

DISCUSSION

Mikulicz in 1876 first described the KCOT as a condition affecting the jaws. However, the term odontogenic keratocyst was first introduced by Philipsen in 1956. In 1960, Shear [4] stated that, 'in most respects, the diagnosis of primordial cysts is of academic importance only. They are entirely simple in nature and will not recur if enucleated.' Since then, a wide range of treatment modalities have been put forward for its treatment.

Treatment modalities

Eyre and Zakrzewska [5] in 1985, stated the following treatment options for the KCOT –

1. Enucleation:
- with primary closure
- with packing
- with chemical fixation
- with cryosurgery

2. Marsupialization:
- only
- followed by enucleation

3. Resection

Bramley [6], in 1971, proposed a treatment plan for the keratinising cystic odontogenic tumor due to its tendency to recur. He suggested:
1. Unilocular cysts to be treated by intraoral resection.
2. In areas of difficult access, decompression and secondary enucleation is advocated.
3. Large multilocular cysts should be treated by resection and primary bone graft.

Use of Carnoy's solution

Carnoy's solution is the most commonly used chemical cauterizing agent used in treatment of KCOT. It is made using 1 part Glacial Acetic Acid, 3 parts of Chloroform, 6 parts of 95%/100% Ethanol. In a systematic review of the treatment and prognosis, Blanas et al. [7] in 2000, have concluded that simple enucleation results in an unnecessarily high recurrence rate when treating the KCOT. For a routine KCOT in a person who is likely to return for a follow-up treatment, Carnoy's solution seems to be the minimally invasive procedure with the lowest recurrence rate. If the lesion is very large, decompression of the cyst may be done, which is followed by enucleation. This sequence of procedures also have a low recurrence rate. The use of Carnoy's solution can also be considered at the enucleation stage of the procedure.. If the patient is not likely to return for follow-up, the lesion should be resected.

Enucleation with Cryosurgical Treatment

Bradley and Fischer [8], in 1975, have described a combined enucleation and cryosurgical treatment for KCOT. Webb and Brockbank [9] in 1984, have also presented the treatment of the KCOT of the mandible using a combination of enucleation and cryosurgery. They followed up the case for 5 years and found no recurrence. This suggests that cryosurgery, as an adjunct to enucleation, may prove to be a conservative and reliable method of treatment of KCOT with a low recurrence rate.

Recurrence of KCOT

The recurrence of the KCOT ranges from 2.5% to 62%. While different studies have shown difference in recurrence rates, the possible mechanisms of recurrence have been described by Voorsmit et al. [11] in 1981. These state that any lining epithelium left behind in the oral cavity may give rise to the formation of a new lesion. Daughter cysts, microcysts or epithelial islands can be found in the walls of the original cysts. New KCOTs may develop from epithelial offshoots of the basal layer of oral epithelium [12]. Both conservative approach and aggressive approach have been advocated for the treatment of the KCOT. Conservative approach, however, has not gained much popularity. This is due to the difficulty in the complete removal of the KCOT, due to its thin friable lining, the limited surgical access, skill and experience of the surgeon. Most importantly, the desire to preserve adjacent vital structures renders the conservative approach as not very popular.

Goals for treatment of KCOT

The goals of treatment should involve eliminating the potential for recurrence while minimizing the surgical morbidity. Enucleation followed by chemical cauterization using Carnoy's solution, followed by excision of overlying attached mucosa has been used for the successful treatment of KCOT. Stoelinga [16] in 2001 concluded in a long term follow up study that this method gave rise to a fairly low number of recurrences. Peripheral ostectomy combined with chemical cauterization using Carnoy's solution may give nil recurrence rate [15]. A strict follow up protocol, which allows for early surgical intervention in case of recurrence, limits the extent of second surgery, therefore, giving rise to less morbidity. It seems very likely that offshoots of the basal layer of the epithelium of the oral mucosa are a major cause for the development of some KCOT and some recurrences.

Resection

Resection of the lesion is said to give the least recurrence rate out of all treatment modalities. Bataineh and Al Qudah [17] in 1998 advocated for resection without continuity defects as a radical treatment. In this, removal of the cyst, teeth and the overlying soft tissue was followed by packing of the resulting cavity in order to minimize the risk of recurrence.

Marsupialization

Nakamura et al. [18] in 2002 have stated that marsupialization, as well as decompression, have the purpose of relieving the pressure within the cystic cavity. This promotes lower recurrence by allowing the growth of new bone that fills the defect. As a result, it saves the structures like tooth roots, maxillary sinus or the inferior alveolar canal. They can be saved from surgical damage by these treatment modalities. They concluded in their study that marsupialization was a highly successful procedure that helped to reduce the size of the KCOT before surgery. It was found to be more effective in the mandibular body region than in the ramus region. It also did not adversely affect the recurrence tendency of KCOT. Some authors have advocated marsupialization as a viable treatment for the KCOT [19,20]. Pogrel and Jordan [20,21] in 2004, treated 10 cases of KCOT by marsupialization. They found that all the 10 cases of KCOT resolved completely solely with this form of treatment. Their study also suggested that the cyst lining may get replaced by normal epithelium during this treatment.

According to Stoelinga [16,22], complete elimination of recurrences is probably not possible. This is because of two reasons.:

1. Some cysts are still treated like ordinary odontogenic cysts. This is because a preoperative diagnosis was not made and the cysts were not treated according to the suggested protocol.
2. Despite excision of the overlying mucosa, there may still be epithelial islands or even microcysts left behind in the mucosa. These may develop into a new KCOT.

Chye CH and Singh B [25] described a case of a large KCOT that had developed rapidly and aggressively over a short period of 2 years and presented with acute symptoms. The KCOT was enucleated and the residual cavity was treated with Carnoy's solution. Kumar M, Bandtopadhyay and Thapliyal GK [26] have reported a case of a KCOT occurring in the anterior mandible which an uncommon site, with the lesion crossing the midline being a unique occurrence. Radical excision has no recurrence but does have the highest morbidity rate and should be reserved for multiple recurrent cysts after conservative means. Tolstunov and Treasure [28] have advocated for a surgical treatment algorithm for KCOT. They reported a combined treatment of KCOT and mandibular defect with marsupialization, enucleation, iliac crest bone graft, and dental implants. Meara et al. [29] have found out an overall recurrence rate of 35%, and the average time to recurrence of 4 years in their clinicopathologic review.

Disadvantages of simple enucleation

Simple enucleation (without curettage) is no longer advocated as an appropriate method for the treatment KCOT. Recurrence rates are highest with this method of treatment and range from 9% to 62.5% [30,31]. Scharfetter et al. [32] in their study on KCOT proliferation, have suggested that a minimum 5-mm bony margin is adequate to ensure satellite cyst removal.

CONCLUSION

Although literature contains many reports regarding management of KCOT, there still is debate as to the most effective treatment for this lesion. Depending on size, location, and behavior, the clinician should decide on an incisional versus excisional biopsy. Prior aspiration cytology may be helpful. In patients with multiple KCOTs, evaluation for the presence of basal cell nevus syndrome should be taken into consideration. Larger KCOTs, with possible cortical perforation, deserve radiographic assessment such as CT in addition to plain films. Treatment of the KCOT varies from enucleation and curettage

to osseous resection. Various factors that should be considered in the selection of the appropriate treatment include size and extent, location, presence of perforation or soft tissue involvement, age of individual, and primary or recurrent nature of lesion. Long-term follow-up is suggested because KCOTs have been known to have late recurrences. Recent factors support emerging molecular evidence that the KCOT is more likely to be a benign cystic neoplasm than a simple odontogenic cyst. This article aims to bring out the importance of clinical awareness about KCOT. It also aims to emphasize the importance of a careful histological examination and the necessity of obtaining biopsy materials from various areas to prevent a misdiagnosis. In the light of recent literature, it may be concluded that an aggressive treatment modality like enucleation with application of Carnoy's solution might be considered as the most appropriate treatment modality for the KCOT.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-27

Anterior Open Bite: Diagnosis And Etiology: A Review

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Abstract: Anterior open bite is one of the common malocclusions encountered by orthodontists in day-to-day practice. It poses both an esthetic and functional challenge for the patient. It is also tricky for the orthodontist to achieve stable results by way of extrusion of anteriors or intrusion of posteriors or a combination of both. Considering how most orthodontic mechanics are extrusive in nature, it is a clinical challenge to achieve true intrusion of posteriors because extrusion of anteriors is unstable. Various techniques have been described over the past years to correct this malocclusion and with the advent of mini-implants, the envelope of discrepancy has expanded allowing more successful non-surgical management of cases.

Keywords: Anterior open bite, molar intrusion, anterior extrusion

INTRODUCTION

Anterior open bite as a term was coined by *Caravelli* in *1842.* It is defines as a condition where there is no contact and no vertical overlap of the lower incisor crowns by the upper incisor crowns when mandible is in full occlusion[1].It is also defines as deviation in vertical relationship of maxillary & mandibular dental arches by *Subtenly and Sakuda.*[2]In the Index of orthodontic treatment needs, it falls under the categories 4e(extreme lateral or anterior open bites > 4mm), 3e(lateral/anterior open bites 2-4mm), and 2e(lateral or anterior open bites 1-2mm) in the dental health component. Less than 4% of mixed dentition population are affected by this malocclusion [3]. Open bites are less common than deep bites and the demand for treatment is around 17%[4]. Prevalence of Anterior open bite malocclusion in India is 1.6% and around the globe is 4.93%. It is classified into *Dentoalveolar and skeletal anterior open bites* by Kim (1974) based on the appearance of the mandible. *Worms, Meskin and Isaacson* classified it into: Simple OB : from canine to canine , Compound OB: from premolar to premolar, Infantile (complex) OB : from molar to molar. *Cooke* in 1981 classified it into Skeletal open bite, Habit or dental open bite, Abnormal tongue function open bite, iatrogenic open bite, Pathological open bite. *Sassouni* classified it into skeletal and dental open bites. *Yamaguchi* in 2010 classified it into Dentoalveolar with alteration in normal eruption of anterior teeth (non-nutritivesucking habits), Skeletal (with long face) – caused by clockwise/backward rotation of the mandible, Skeletal – caused by skeletal deformities like tipping of the maxilla and diversion of the mandibular gonial angle. *Moyer's* classified it into Simple open bite-confined to teeth and alveolar process with failure of some teeth to meet the line of occlusion and Complex open bite characterized by primary vertical dysplasia frequently associated with Class-I and Class-II malocclusions and occasionally associated with Class III malocclusion. *Andrew and Richardson* classified it into Transitional open bite:- when the permanent teeth are erupting with incomplete growth of dento-alveolar regionand this anterior open bite undergoes spontaneous correction. Digit sucking open bite:-Eruption of incisors impeded by digit sucking leading to Anterior open bite. Habit breaking therapy corrects this anterior open bite.

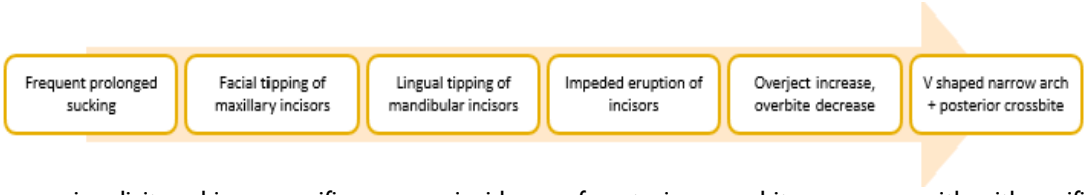
Etiology

The etiology could be:

- Genetic
- Environmental
- Habits(persisting in permanent dentition)
- Abnormal tongue function – endogenous/adaptive tongue thrust
- Trauma/pathology affecting condyle
- Pathological- ex. CLP, acromegaly, trauma
- Neurological disturbances
- Muscular dystrophy
- Iatrogenic ex. Extrusion of molars during treatment – palatal cusp hang/ 2nd molar eruption in functional therapy
- Respiration- minor influence on vertical and transverse jaw dimenions

Effects Of Sucking Habits

- Advocates of breastfeeding reduced prevalence of malocclusion with no difference on the long run with longer breastfeeding periods leading to fewer non-nutritive sucking habits. Sucking during primary and early mixed dentition may affect the alveolus but main effect- eruption of permanent dentition- **Frequency**(hours/day) **and** duration(months/years)[5]



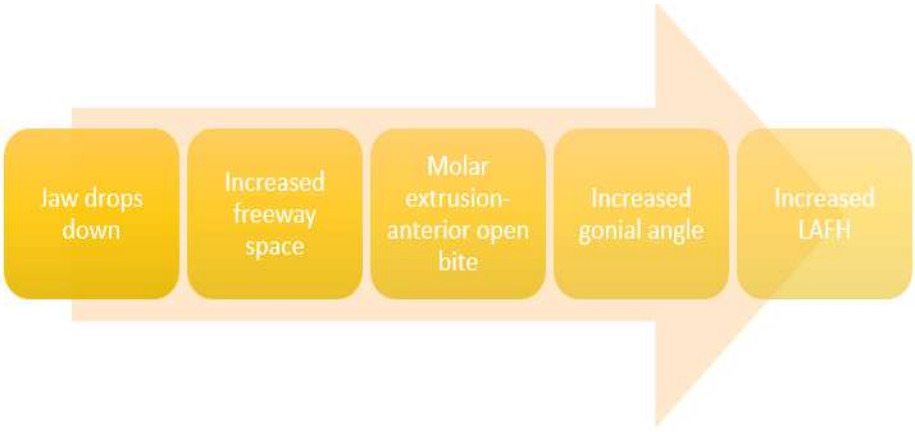
• On comparing digit sucking vs pacifiers- more incidence of posterior crossbites are seen with with pacifiers especially when use>18 months. Most children have non-nutritive sucking at 24 months[6], only 40% at 36 months (*McNamara 2006)*. Habits decline with age- pacifier use less common when compared to sucking habits- social pressures of school. If habits stop before eruption of permanent teeth there is spontaneous resolution- except posterior crossbite.

Intervention

Non dental interventions include: straightforward discussion of consequences, reminder therapy, reward systems, and elastic bandage around elbow. Appliance therapy may also be done as a helping hand and not a punishment. Removable reminder appliance contraindicated as compliance is a real issue with the treatment effectiveness. Maxillary lingual arch with crib can be used to manage the habit and in about half of the children- thumb sucking stops, Anterior open bite closes rapidly. The crib is effective in extinguishing thumb sucking in 85-90% patients.[7]In primary dentition, treatment isn't indicated, or orthodontic dummy may be prescribed if the habit is dummy related. Parents can be reassured that the issue will resolve with habit cessation. In early mixed dentition, patient can be adviced and motivated by way of rewards. In late mixed dentition deterrent appliance may be prescribed and upper arch expansion may be indicated. In permanent dentition, spontaneous resolution of the anterior open bite is highly unlikely.
Anterior open bites may be secondary to a tongue thrust and vice-versa. The tongue thrust may be:

- Simple
  - Normal tooth contact in posterior region
  - Anterior open bite
  - Contraction of the lips,mentalis muscle and mandibular elevators
- Complex:
  - Generalised open bite
  - Absence of contraction of lip and muscle
  - Teeth contact in occlusion
- Lateral tongue thrust:
  - Tongue thrusting laterally with posterior open bite

Inadequate nasal airway creating the need for an oral airway, could be because of structural abnormalities or blockages in the nasopharynx or skeletal abnormalities.



Muscular dystrophy may also have a secondary presentation of mouth breathing. Condylar resorption due to traumatic injuries or systemic reasons may also be a contributing factor in the etiology leading to a sudden open-bite due to bilateral condylar resorption. Excessive growth of maxilla in those with Cl II malocclusion- more downward than forward movement of maxilla prevents mandibular anterior growth. In some- tendency self corrects without intervention, in some others continues through adolescence and post adolescent years - even successful treatment must be retained into late teens early 20s. Efforts must be made to stop/decrease maxillary posterior vertical growth and facilitate upward and forward rotation of mandible. *Cangialosi 1984 presented a* Great variability in dental and skeletal morphology in patients with open bites. They have a tongue thrust type of swallow to establish lip seal. [8]

Types
Skeletal anterior open bite

- Extra-oral features of
- Long face
- Lip incompetence

- Steep FMA
- Marked antegonial notch
- ↑AFH, ↓PFH; reduced UFH:LFH
- IntraOral features of
- Mild crowding, upright incisors
- If severe may occlude only on 7s
- Gingival hypertrophy due to mouth breathing
- Maxillary, occlusal and palatal planes tilt upward, mandibular occlusal plane canted downward

Dental Anterior Open-bite

This is caused mainly due to digit-sucking or other nonnutritive sucking habits. It has the following intra-oral features:

- Arches have features related to the etiology- eg. Thumb sucking: proclined upper incisors, depressed retro lined lower incisors
- Open bite limited to incisor region- asymmetrical
- Narrow maxillary arch with cross bites
- Tilting of maxillary plane and anterior displacement
- 'Fish-mouth' appearance
- Severity depends on age, intensity, frequency and duration (↑6hrs)[9,10,11,12.]

Cephalometric features

- Normal maxillary palatal plane with a canted occlusal plane, decreased dent alveolar height anteriorly, increased posteriorly. [13]

DISCUSSION

Several studies have related the morphologic aspects of malocclusion to mandibular dysfunction in children. Williamson surveyed 304 pre-orthodontic patients (aged 6-16) and found that 72% of those with pain dysfunction symptoms had either open bite or deep bite [14] They also found that functional malocclusion due to occlusal intereferences was more important than morphologic malocclusion in the etiology of mandibular dysfunction but that morphological malocclusion such as crossbite and anterior open bite might be a potential risk factor.In a larger longitudinal study with 7337 Japanese children, the prevalence of open bite was found to be 12.2%[15].

CONCLUSION

As mentioned by Mirzahi, 1978, '*The greater the skeletal elements contribute to the aetiology, the poorer the prognosis for treatment.*' [14]. There are four mainstays to correcting an anterior open-bite, viz., Habit cessation, Orthodontic treatment, Orthognathic approach and a combination therapy. [15]

CONFLICT OF INTEREST

Conflict of interest declared none.

FUNDING SOURCE: Nil

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SP-28

Asymmetric Expansion Using Quad Helix For The Correction Of Unilateral Crossbite- A Case Report.

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Abstract: Maxillary transverse deficiency results in a posterior crossbite which can be orthodontically or orthopaedically corrected using expansion appliances. Expansion can be either produced symmetrically such that the arch expands uniformly, or asymmetrically, where one section of the arch expands more than the other.Unilateral crossbites that may or may not be isolated to a single tooth are more challenging to correct than bilateral crossbites. Quad helix is a slow maxillary expansion appliance that has been very effective over the years.This case report shows the use of a quad helix for asymmetric expansion to correct a unilateral crossbite.

Keywords : Quad helix, Crossbite, Unilateral, Asymmetric expansion, Slow expansion

INTRODUCTION

An inadequate transversal relationship between maxillary and mandibular teeth is identified as any abnormal buccal-lingual relation between opposing molars, premolars or both in centric occlusion. When the buccal cusps of the maxillary teeth are in contact with the central fossae of the mandibular teeth, it is defined as a posterior crossbite. According to some studies, the prevalence of posterior crossbite ranges from 8 to 16 percent. A posterior crossbite is believed to be transferred from the deciduous to the permanent dentition and can have long-term effects on the growth of jaws. The etiology of this malocclusion could be most commonly due to potentially damaging oral habits or early primary tooth loss.The probability of posterior crossbite correcting itself is very small without any intervention (0-9%).[1,2] Expanders for treating maxillary transverse deficiency have been used for over a century. There are four expansion treatment modalities that are used, namely rapid maxillary expansion (RME), slow maxillary expansion (SME), surgically assisted rapid palatal expansion (SARPE) and mini-implant assisted rapid palatal expansion (MARPE) with each having their own indications, contraindications, advantages and disadvantages.[2,3] Slow maxillary expansion appliances basically produce dentoalveolar expansion or changes. The rate of expansion producedby the appliance is less when compared to the rapid maxillary expansion appliances. They usually provide few hundred grams of force around 2 lb of pressure, with the expansion carried out at the rate of 1 mm/week. Slow expansion appliances can be removable or fixed.[4,5] The quad helix appliance was introduced by Ricketts and popularised by Bench.[6]It is made of 0.038 inch (0.975 mm) stainless steel or elgiloy wire soldered to the molar bands. It incorporates four helices or coils to increase its flexibility. The parts of a quad helix include: (1) posterior helix, (2) palatal bridge, (3) anterior helix, (4) anterior bridge and (5) outer arm The anterior bridge lies in between the two anterior helices in the canine region. The palatal bridges lie on either side between the anterior and posterior helices. The posterior helix should not extend more than 2 mm distal to the permanent first molar and the outer or the buccal arms are soldered to the molar bands. An initial expansion of 8 mm will produce 14 oz of force. Average force is 200–400 g depending upon the amount of expansion or activation.[4,5,6]It has a fan-like sweeping action that is attributed to the appliance design, which helps in achieving expansion in the premolar region as well. It also has a distal rotation effect on the molars and can also be used for molar derotation.[6] Apart from arch expansion, quad helix is modified for other purposes. Bending the anterior bridge downward or adding additional anterior bridge, it can be used for breaking thumb sucking habit. If tongue spikes are soldered to the anterior bridge, it is used for intercepting tongue thrusting habit. Incorporating helices in lateral arms, near the anterior end, can be used for anterior expansion.[4,6] In this case report, we have used a quad helix that has been activated asymmetrically to correct a unilateral crossbite.

CASE REPORT

A 16-year-old boy reported to the Department of Orthodontics complaining of irregular teeth and desired to get it corrected orthodontically. His history elicited no relevant past medical or dental history and he is in good general health. Extraoral examination showed symmetrical vertical and horizontal facial proportions, mesocephalic facial type, straight facial profile, with competent lips. Intraoral examination showed the presence of 28 teeth except the third molars, with fair oral hygiene. He had U-shaped dental arches with a buccally blocked out upper right canine and mild crowding in the lower anteriors. The upper midline was shifted to the right by 3mm and the lower midline to the left by 2mm of the facial midline. The molar and canine relationships were class I on both sides with reduced overbite and overjet. He had a unilateral posterior crossbite on the left side affecting 25 and 26. The case was diagnosed with Class I malocclusion with crowding in upper and lower anteriors with unilateral posterior crossbite on the left side. (Figure 1) The patient was advised to undergo fixed orthodontic treatment. The treatment plan was to use MBT .022 bracket prescription using the non-extraction approach as the patient had a pleasing profile with lip competency and an average nasolabial angle. Extraction as a method of space gaining to relieve the crowding would be inappropriate in this case as it would leave a dished-in profile and reduced lip support due to over-retraction of teeth. A quad helix was planned to correct the unilateral posterior crossbite. In the first visit, oral prophylaxis was done and elastic separators placed to create space for banding the upper molars. In the second visit, the separators were removed and band adaptation was done. Alginate impressions were taken and the bands were transferred to the impression and dental

models made. This was used for the laboratory fabrication of the quad helix. Upper and lower dental arches were bonded with stainless steel brackets. The quad helix was fabricated in the laboratory using an 0.038 inch (0.975 mm) stainless steel wire. The standard design of the quad helix was used and soldered to the bands. (Figure 2a,2b) In the third visit, the quad helix was installed into the patient's mouth and archwires placed. (Figure 3) The quad helix was activated extraorally before insertion. The quad helix was activated by opening the left anterior and posterior helices to move the left outer arm laterally which will produce a unilateral expansion effect. An activation of 5mm was done initially. (Figure 2b) Reactivation was done by 2mm every 6 weeks until the correction was achieved. It should be kept in mind that unilateral activation of the appliance will have a distalising effect on the opposite side molar. This turned out favourable in this case to increase the dental arch length to correct the crowding and correct the midline. 7 months into treatment, the unilateral posterior crossbite was corrected and the appliance was left to remain in place passively for another 3 months as a supportive phase. After quad helix expansion, 25 and 26 were corrected from the crossbite condition and the upper midline was also corrected. The before and after expansion photographs are presented in figures 4a and 4b.

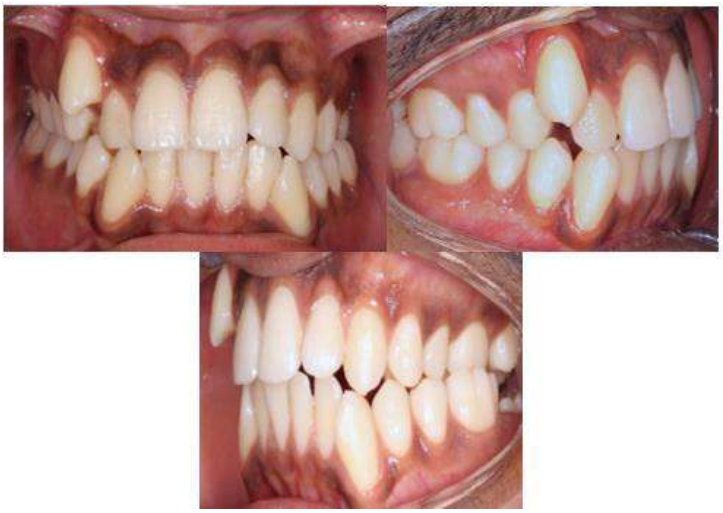

Figure 1
Intraoral photographs

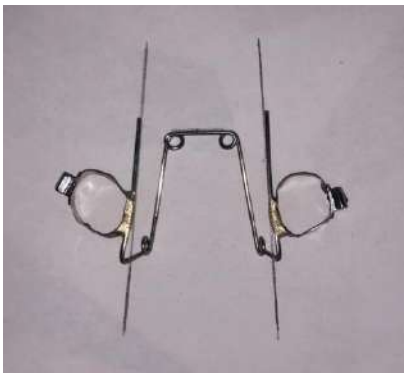

Figure 2a
Quad helix design

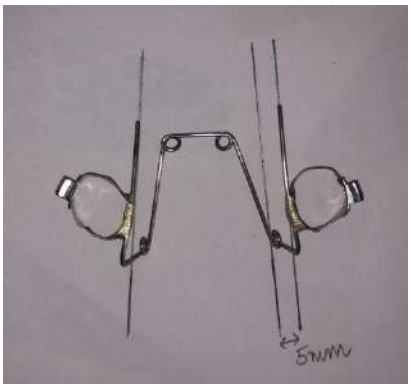

Figure 2b
Quad helix activated

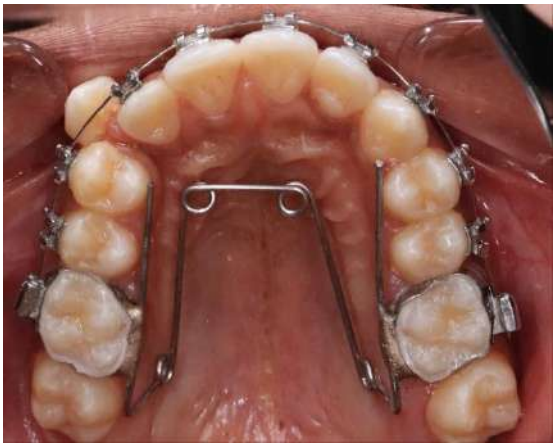

Figure 3
Quad helix appliance installed and fixed orthodontic treatment started.

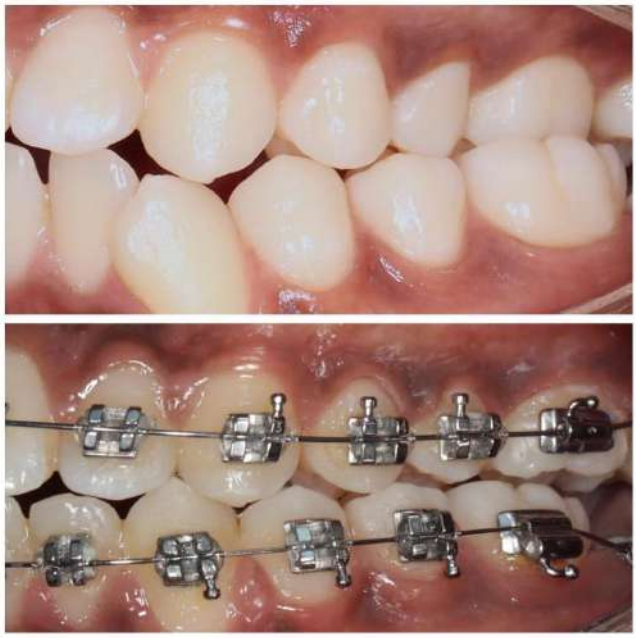

Figure 4a
Before and after posterior crossbite correction

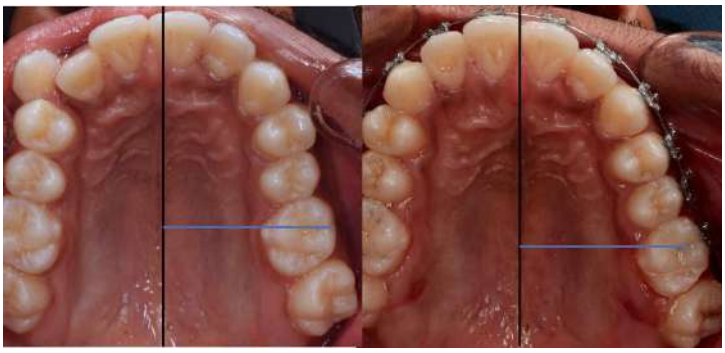

Figure 4b
Before and after use of quad helix for unilateral expansion.

DISCUSSION

Quad-helix is one of the slow maxillary expansion (SME) appliances that gives a more continuous action of force at low levels.Frank[7] (1982) states that the movements produced in quad-helix treatment are predominantly orthodontic with 6:1 ratio with skeletal movement.The advantages of quad-helix are good retention, wide working range, differential expansion, breaking oral habit, molar rotation effect, less patient compliance, and durable. Expansion is smooth and controlled and in young

children, skeletal expansion can be achieved. It provides excellent expansion in cleft palate patients. One major disadvantage of this appliance is buccal tipping of molars during excessive activation. This can be prevented by torquing the roots buccally.
Unilateral posterior crossbite treatment using quad-helix in this case produced satisfactory progress. This appliance was tolerated well by the patient although ulceration of palatal mucosa due to left posterior helix occurred, but treated successfully. This is one of the disadvantages of quad-helix, i.e. irritating soft tissues.Quad-helix wasn't damaged, didn't cause difficulty talking, oral health issue or masticatory difficulty. Some authors in the past have also reported the successful use of a quad helix appliance for unilateral posterior crossbite correction. [8,9,10] In this case, the quad helix proved to be a very efficient appliance to correct the unilateral posterior crossbite, which was less cost-effective, and well-tolerated by the patient. Slow maxillary expansion appliances basically produce dentoalveolar expansion or changes. The rate of expansion producedby the appliance is less when compared to the rapid maxillary expansion appliances. They usually provide few hundred grams of force around 2 lb of pressure, with the expansion carried out at the rate of 1 mm/week. Slow expansion appliances can be removable or fixed.

CONCLUSION

Quad-helix can be used for correction of unilateral posterior crossbite by asymmetric expansion. However, an appropriate diagnosis, problem list and integrated treatment plan should first be developed. Thanks to its simplicity and efficacy, the modified Quad Helix here described is easy to fabricate, versatile, and useful to resolve an isolated crossbite. The advantages of this modified appliance are significant and include simple design, easy construction, minimal cost, and better results. In fact, it is never simple to obtain an orthodontic asymmetric movement of a molar, also due to the spatial position that the molars occupy in the oral cavity, being close to gums that can be damaged by bulky orthodontic appliances. In addition, a simpler device will be easier to control, with less costs and less time to care, and therefore much more tolerated by the patient.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-29

Niti And Newer Nickel Free Super-Elastic Arch Wires

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Abstract: NiTi is one of the most popular alloys in the medical world today, owing to its shape memory, super-elasticity and low elastic modulus. It has it's niche in the field of Orthodontics as well, due to the ability of the alloy to deliver light continuous forces, which is biologically and physiologically optimal to effect tooth movement without any detrimental effects on the periodontium. Due to the concerns around Ni hypersensitivity, in NiTi which has 55% Ni, and hence, the potential for causing the plethora of allergic reactions associated with Ni^{2+} ion release, various alternative Nickel free alloys have been developed, primarily those in combination with β Titanium. More recently, Shape memory polymers are also being studied (SMPUs- Shape Memory Poly Urethanes). These alloys and polymers have the potential to combine the advantage of shape memory and super-elasticity and completely circumventing the possibility of Ni based allergies because these archwires are practically Ni free. There is still a lack of clinical evidence and most of the studies are carried out *in vitro* or in animals, but they are significant nonetheless.

Keywords: NiTi**,** Superelasticity, Shape Memory, Ti based alloys, Shape memory Polyurethane (SMPU), Ni allergy

INTRODUCTION

Nickel Titanium has almost been analogous with the terms superelasticity and shape memory, atleast with respect to practical biomedical applications. It has come a long way, since its inception and first commercially available form – *nitinol,* by William F. Buehler and his associates, the name being an acronym for the *Ni*ckel *Ti*tanium *N*aval *O*rdnance *L*aboratory, in Silver Springs, Maryland, originally made for use in space research in the 1960s.[1] It was then popularized by Andreasen as an effective orthodontic archwire, in the year 1971[2] Over the years various new modifications were made to NiTi [3,4,5] Though various physical and mechanical properties of NiTi have been extensively investigated[3-8], those that are of the most importance are the super-elasticity and shape memory[9-14]. With NiTi, it is possible to deliver light continuous forces which is physiologically optimal as it prevents hyalinization of the periodontal ligament but at the same time, ensures bone remodeling at an optimal pace for efficient tooth movement, especially useful in the initial levelling and alignment phases. [15] Due to the high Nickel content in Ni based alloys like NiTi (55%) and the long duration of contact in Orthodontic treatment, there is some concern about the biocompatibility of the alloy. Though it is usually well tolerated, it potentially puts the patients at the risk of Nickel hypersensitivity [16] and contact dermatitis [17.] 40-70% of patients with contact dermatitis can develop hand eczema which may be acute or chronic. This is caused mainly due to the Ni^{2+} ion release. This ion release is also influenced by the surface defects that increase Ni^{2+} ion release due to corrosion. [18] Due to the concern about the biocompatibility of Ni based alloys, Ni free shape memory and superelastic alloys are being developed studied in recent times. Cu-Zn-Al and Cu-Al-Ni were studied for their good properties and low cost but Cu, Ni, and Al, aren't too great on the biocompatibility front.[19] β titanium alloys offer low elastic modulus, greater ductility, corrosion resistance [20,21]when compared with alloys that are a combination of α+β Ti. In relation to the stability of the β phase, the alloys can even possess the properties of shape memory and superelasticity. These qualities are courtesy of a reversible solid-state phase transformation called martensitic transformation which occurs by thermal (increase in temperature) or mechanical (relieving stress) means, from the martensitic phase; and leads to the shape memory effect and superelasticity respectively. [22] Some of the various Ti based superelastic alloys that have been developed and studied are Ti-Nb-Sn [23], Ti-Nb-Al [24], Ti-Nb-Ta [25,26], Ti-Nb-Zr [27,28], Ti-Nb-O [29], Ti-Nb-Pt [30], Ti-Mo-Ga [31], Ti-Mo-Sn [32], Ti-(8-10)Mo-4Nb-2V-3Al (mass%) [33]. Hence, this review article will explore the various new developments, for nickel free alternatives, in its limited capability.

SHAPE MEMORY AND SUPERELASTICITY

Metallurgic aspect:

Shape Memory Effect

When the alloy is deformed at a temperature below the M_f (Martensite finish temperature) and subsequently heated to a temperature above the A_f (Austenite finish temperature), the shape is recovered. Martensite transformation by shape memory is thermally induced. On decrease of temperature from M_s to M_f, there is growth of existing martensite plates and nucleation of new ones. On increase of temperature from M_f to M_s, the inverse occurs, that is shrinkage and disappearance of plates. This confirms a stress-temperature equivalence, as both decrease in temperature and an increase in stress stabilize the martensitic phase.[34]

Superelasticity- SIM

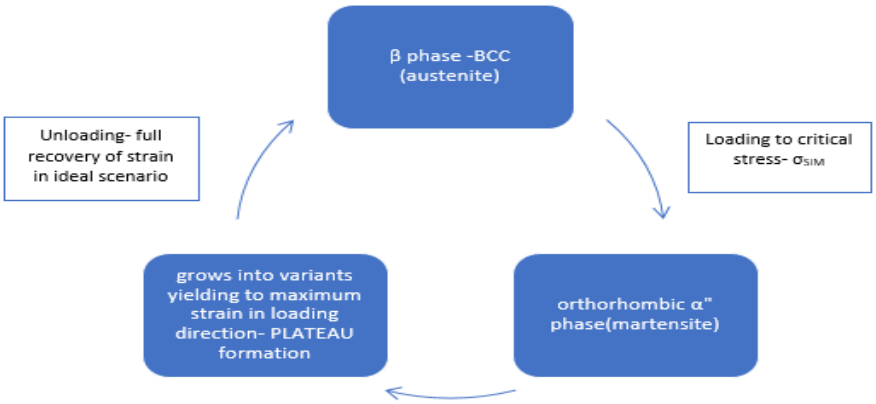

Fig. I
Schematic diagram representing SIM transformation in β Ti

Even at temperatures above M_s, Martensite can be formed on applying a certain amount of stress, and this is called SIM (Stress Induced Martensite) when the deformation occurs above A_s but below M_d. The stress required for SIM (σ_{SIM})is proportional to the Transformation temperature in various alloy systems [34, 24-26] obeying the Clausius-Clapeyron equation, that characterizes the discontinuous phase transition between two phases:

$d\sigma/dT_t = \Delta H/T\varepsilon_0$
ΔH – Transformation latent energy, T_t – Transformation Temperature, σ – stress, ε_0 – Transformation strain parallel to direction of applied stress.

The stress required for SIM transformation is directly proportional to the temperature upto the critical desist temperature M_d, at which point, the stress required for martensitic transformation is greater than the critical stress required to activate motion of dislocations, meaning that the SIM transformation occurs between M_s and M_d.
The stress that is applied to the Austenite, gets retained and the material transforms to Martensite (loading) and the reverse occurs as the stress is released (unloading) and Austenite is formed. The crystallographic reversability, is on account of the martensite plate reversion due to backward shear. [25]

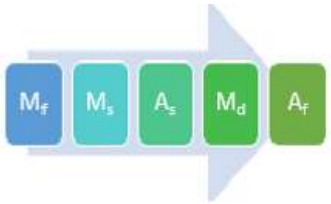

Fig. 2
Schematic representation of the Temperature Transition Range

SUPERELASTICITY IN β Ti ALLOYS

In β Ti, commercially available TMAs are not superelastic, and hence in this article the various alloying elements that are added, thermomechanical treatments and the crystallographic texture differences, and striking a balance between these factors, in order to influence and modify the physical and mechanical properties to offer a superelastic advantage are explored below.

GENERAL COMPOSITION OF NEWER Ni FREE Ti BASED SUPERELASTIC ALLOYS

CpTi (Commercially pure Titanium) can exist in two forms, α (stable hcp structure, below 822^0 C) and β (stable bcc structure above 822^0 C). α stabilizers are those elements that's stabilize the α-Ti microstructure. β stabilizers like Vanadium (V), Molybdenum (Mo), Tantalum (Ta) are added to stabilize the β-Ti microstructure at room temperature. β Ti is preferred for orthodontic use, because of its lower elastic modulus and higher ductility than α Ti alloys, and is widely used in the form of TMA (Titanium Molybdenum Alloy). These newer alloys generally contain β stabilizers, certain neutral alloying elements, and the structure is a metastable β microstructure, where in, martensitic transformation occurs on application of stress (SIM transformation).

ALLOYING ELEMENTS
β stabilizers

The β phase stability and σ_s (critical stress for dislocation slip) are very critical for superelasticity and β phase stability should fall within a very narrow range, low enough, to allow SIM transformation with twinning, high enough to retain a full β phase on

rapid cooling to room temperature (M_s is below the room temperature) [25] and the critical stress for slip dislocation should be increased so that the martensitic transformation is preferred over slip dislocation. Only a small range of alloy compositions can offer this. Some examples are:

- Nb as β stabilizer: Ti-(22–25) at.% Nb alloys exhibiting shape memory effect and Ti-(25.5–27) at.% Nb alloys exhibiting superelastic behavior
- Mo as β stabilizer: (Ti-Zr)-Mo-Sn [35], Ti-Nb-Mo-Zr-Sn [36]
- Fe as β stabilizer: Ti-Zr-Nb-Fe [37]

Though Nb reduces the transformation temperature, it decreases the transformation strain, which has a negative impact on the superelasticity of the alloy.[22] This can be countered by addition of various ternary and quaternary elements, thereby reducing the Nb content. These elements basically decrease the martensite transformation temperature, ensure that there is a minimum decrease in the transformation stress and an increase in the critical stress for slip deformation, for improved superelastic properties. Addition of ternary alloying elements like Pt has also been studied and is said to be 4 times as effective as Nb, in reducing the M_s temperature and 3 times as effective than Nb, in reducing transformation strain [30]. The addition of Al, to the binary Ti-Nb has also been studied. Though it's an α stabilizer, it enhances the shape memory and superelasticity of Ti-Nb alloys. With increase in Al content, the transformation temperatures decrease and superelastic behavior is observed at 24 at. % Nb, for Ti-*x*Nb-3Al. Maximum recovery strain of over 4% observed in rolling direction, for Ti-24Nb-3Al. Various aspects of Ti-Nb-Al alloys have been studied [24].

Other Elements – Zr, Sn

β Ti alloys with high recoverable strain (on thermomechanical treatment) have quarternary neutral alloying elements like Zr(though Zr isn't neutral in Ti-Nb based alloys) and Sn added so that:There is an increase in the recoverable strain(ε_{rec}) and a decrease in transformation temperatures. (less reduction in transformation strains and equal or more reduction in M_s on replacing β stabilizers like Nb and Ta. Ex.1. There is an observable reduction in M_s of 35 K in Ti-22Nb [38] and 42 K in Ti-30Ta [39] per atomic % of added Zr. Addition of Zr, leads to the lowest reduction in transformation strain and similar reduction in M_s. Ex. 1. Ti-22Nb-6Zr with 6 at.% Zr, has increased ε_{rec} from 3% in Ti-(26-27) at.% Nb[41] to 4.3% in Ti-22Nb-6Zr. [28] Ex. 2. Ti19.1Nb8.8Zr [40] exhibits reversible martensitic transformation and superelastic behavior, and has better corrosion resistance than NiTi and excellent biocompatibility (as reported in cell culture studies) and has a good potential for biomedical applications. Suppressing ω phase and decreasing elastic modulus: β Ti superelastic alloys have a lower than average elastic modulus as opposed to the conventional Ti alloys, due to the plateau on the stress-strain curve which is caused by the SIM reversible transformation. The Intrinsic elastic modulus is related to the phases and their stability. Highest Elastic modulus is observed in the ω phase, followed by the α', α" and β phase in that order. [41-43] The metastable athermal β phase is susceptible to conversion to ω phase on quenching [38] and this would cause an increase in the elastic modulus of the material irrespective of whether the material is in an athermal/isothermal ω phase. Isothermal ω phase increases the recoverable strain [44] due to precipitation hardening that ultimately increases critical stress for dislocation slip but athermal ω phase causes an increase in hysteresis, which negatively affects the superelastic properties [38], so the actual effect of the ω phase on the superelastic properties are not very clear.Ex. 3. Addition of Sn, reduces athermal ω phase and reduces M_s temperature by 150 K per 1atomic % Sn in Ti-Nb-Sn alloys. [39, 45, 46]

Interstitial Alloying Elements

One of the major drawbacks of just the binary Ti-Nb system were the low critical stress for slip. Substitutional alloying elements like Zr, Ta, Al, Pt and Sn do not have much effect on the critical stress for slip.[19] Interstitial elements like O, N and B increase the critical stress for slip and also improve the superelasticity. They are used for maintaining the β phase stability, lead to a suppression of α" phase and a decrease in the M_s temperature [47-50] Ex. 1% O addition to Ti-22Nb and Ti-Nb-Ta-Zr alloy systems decreases M_s by 160K [51] addition of N, has a similar effect with respect to the M_s and suppression of the α" phase. Also observed is an increase in the critical stress for slip dislocation, improving the super-elasticity. [49]

Heat treatment

Superelastic properties of the Ti-Nb alloy can be improved by thermo-mechanical heat treatment, when it is heated to a temperature below the recrystallization temperature, following severe cold-working. Aging can also be carried out, by heating between 473 and 673 K which increases the critical stress for slip dislocation (fine and dense ω precipitates) and stabilizes the superelasticity. ω phase isn't very beneficial for the mechanical properties of Ti based alloys, but ω precipitates (10-50 nm) improve the superelasticity without affecting the ductility. [44] Low temperature annealing followed by aging, leads to excellent superelastic properties due to the combination of work hardening and age hardening.

Crystallographic texture

B Ti alloys have excellent cold-workability and the texture evolution during cold working and the heat treatment influence the superelasticity. The Superelastic properties are highly influenced by the crystallographic orientation density due to the varying amounts of strain in the different axes. (Bulk of the transformation strain distributed among the various crystallographic orientations) This anisotropy with textural evolution shows improved superelastic properties and is observed in, but is not unique to Ni free Ti based superelastic systems. [53, 54] It's also observed in Cu [55] and Fe[56] based superelastic alloys, and NiTi[57].

Orthodontic applications of shape memory archwires
Ti-Nb-Al

Two animal studies have been conducted to evaluate the application of Ti-Nb-Al (Ti-24Nb-3Al) in rats to compare the efficacy of this superelastic alloy with NiTi. The studies compared palatal [58] and buccal [59] tooth movement with springs, of both NiTi and Ti-Nb-Al. Both of them concluded that the efficiency in tooth movement of the Ti-Nb-Al alloy was comparable with that of NiTi, with the added advantage of being biocompatible, and hence would make an excellent alternative to NiTi as a Ni free Shape Memory Alloy. [58,59] In one of the studies, it was found that the initial force magnitude of the Ti-Nb-Al springs was almost half that of NiTi, hence the forces exerted would be lighter, and continuous, rather than the step-wise fashion observed in NiTi. After 17 days, there was practically no difference in the tooth movement when compared with NiTi.[59] Hence these could be tested further in-vivo, for longer periods and more varied applications so that they could prove to be an effective substitute to NiTi.

SMPUs

Jung in 2008 studied the application of Shape Memory Polyurethane in Orthodontics. The archwire was formed by melt-spinning a block of Polyurethane copolymer and this was synthesized from 4,4'-methylene bis(phenylisocyanate), poly(e-caprolactone) diol (PCL), and 1,4-butanediol. It had observable high shape recovery force (70 gf at 40% hard segment content) which was preserved even after one month following the shape recovery test, at a constant temperature of 50^0 C. In the first 2 hours there was an exponential decrease in the shape recovery force, but it reached an equilibrium and stabilized at 50 gf at around 20 days of treatment. Orthodontic tests were carried out on the model *(in-vitro study)* and alignment of mal-aligned teeth was possible. [60] Further studies conducted by Liu et al in 2017 and 2018 showed that there was an inevitable decrease in force applied when compared to a metal wire, though the recovery force was within the required magnitude in plain SPMUs [61] and hence strengthening by reinforcing will filler materials like Glass Fiber, forming Glass Fiber Reinforced Shape Memory Poly-Urethane (GFRSMPU) was done. GFRSMPU, showed a significant improvement in the mechanical properties along with preservation of shape memory.[62] These polymer archwires could be part of novel orthodontic treatment practices, and provide an aesthetically satisfactory appearance, along with increased biocompatibility and the advantage of shape recovery in oral temperatures, during the course of orthodontic treatment.

CONCLUSION

Ti based superelastic alloys, have various biomedical and non-medical applications, due to their superior mechanical properties, like low elastic modulus, increased corrosion resistance and hence improved biocompatibility. They have a vast unexplored potential in relation to dental applications, as only in-vitro and animal studies have been conducted until now, and they have to undergo clinical trials before being commercialized. Some of the most popular bio-medical applications apart from dental use are load bearing implants and self-expanding stents. With further research and clinical trials with Ni free superelastic alloys, the entire profile of shape memory alloys could change. Apart from shape memory alloys, newer non-metallic Poly-Urethane based polymeric archwires have also been extensively studied(in-vitro), and have very recently been reinforced with Glass fiber, for improved mechanical properties.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-30

Efficiency Of Customized Connectors In Evaluatingmini Implant Stability Using Resonance Frequency Analysis – An In Vitro Study

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Abstract: Mini-implant stability depends on primary stability followed by a consolidating period of secondary stabilization and to determine primary stability a non-invasive,clinically efficient modality is required. Torque measurements are effective only during insertion and removal of implants hence it is not efficient in measuring implant stability during treatment.Resonance frequency analysis (RFA) effectively and non-invasively measures the stability of mini-implants as and when desired .The only disadvantage is RFA device cannot be used effectively as a chair side procedure as it warrants the use of connector to establish a stable coupling between the device and implant head. The objective of the study was to design customized connector that aids in using RFA as a chair side routine procedure to evaluate prognosis of mini-implants.16 mini-implants (1.5 * 8 mm - Bioray) were inserted in fresh goat mandible . The Osstell™ Mentor device for RFA was used which demands stable coupling between SmartPeg transducer and the mini implant .Hence a stainless steel connector was manufactured that snugly fits to the miniimplant head on one side and screw type attachment for SmartPeg on the other . RFA and Periotest were performed parallel and perpendicular to bone fibers.The mean ISQ value for RFA 63.25+/-10.25 , and Periotest was 1.53+/-2.39 . Differences between the two directions of measurement were statistically significant (P < 0.001) and high correlation (r =-0.939) was established for RFA and Periotest.Results concluded that customized connector was efficient in measuring the resonance frequency and can be used as routine chair side aid to assess miniimplant stability.

Keywords: Implants, Resonance frequency, Connectors, Periotest.

INTRODUCTION

Orthodontic mini implants play anintegral role in augmenting anchorage for orthodontic tooth movement. The success of mini implants depends on primary stability followed by a consolidating period of secondary stabilization. Hence, primary stability is regarded as the key indicator of success and varies according to bone quality, implant material, cutting edge design, and clinical factors[1,2]. In order to ensure the success of mini implants and its primary stability, a non-invasive,reliable and clinically efficient modality is required . There are different methods to measure the stability of mini implants. The most widely reported approach is measurement of maximum insertion and removal torque for which precise torque sensors are required .While these torque sensors are effective only during insertion and removal of the implants,Resonance frequency analysis (RFA) stands out by being effective in measuring the stability of mini implants as and when desired . During RFA a small bending force is applied to an implant through a transducer (SmartPeg)[3].The only disadvantage is thatwhen a detection device (Osstell ™ Mentor instrument) is used for resonance frequency analysis (RFA), stable coupling between the SmartPeg transducer and implant is required. A transducer suitable for the size and structure of a particular mini implant may be difficult to obtain. Hence this niche has been filled by a customized connector that has been designed for both orthodontic mini screw and smartpeg making it possible to measure the resonance frequency chair side at frequent intervals. In this study, the customized connector is made for a commercially available mini-implant. The main advantage of RFA over traditional methods such as torque assessment is the ability to perform measurements without changing or disrupting the mechanical characteristics of the bone-implant interface.[4]

AIM

To design a customized connector that aids in using RFA as a chair side routine procedure to evaluate the prognosis of mini implant

MATERIALS AND METHODS

A total of 16 (N= 16) orthodontic titanium micro-implants of size 1.5 mm diameter and 8 mm length from Bio ray(Fig 1)were tested .

FIG I
(IMPLANT)

Fresh goat mandibles were used for testing as an experimental model as there is a similarity of micro anatomical dimensions between the goat and human mandibles, making it more suitable for many implant experiments concerning biomechanical testing5.Eight fresh goat mandibles without any overt osseous pathology were used for this study. The collected mandibles were kept refrigerated until use. The miniscrews were placed 5mmbelow the cement enamel junction in the posterior region(Fig 2).

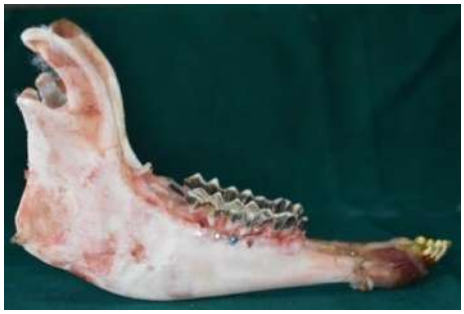


FIG 2
(Fresh goat mandible)

The miniscrews were inserted manually until full engagement of thread. Feeling the final resistance of bone during insertion was considered as the indicator for primary stability .The Osstell TM Mentor instrument (Fig 3) a commercially available device for resonance frequency analysis was used.

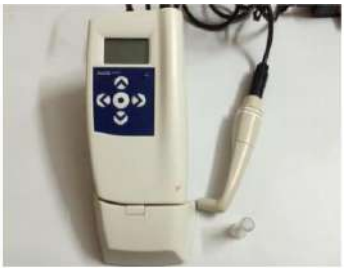
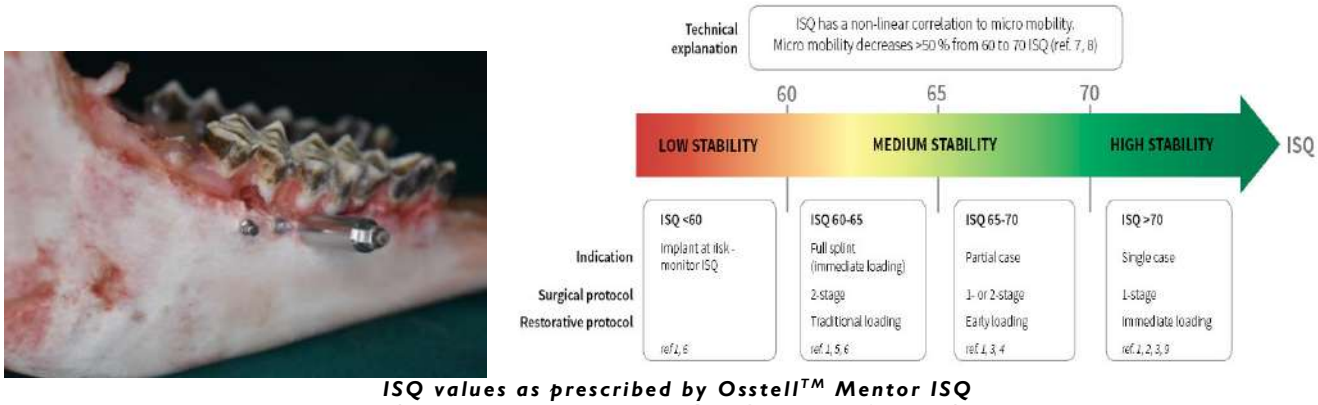


FIG 3
(Osstell Mentor instrument)

None of these systems had aconnector for performing resonance frequency analysis with the OsstellTM Mentor Resonance Frequency Analysis device. Hence, a stainless steel connector has been manufactured and customized for commercially available miniimplant –BIORAY. It snugly fits to the mini implant head on one side and a screw type attachment for the SmartPeg transducer on the other (Fig 4).

Fig4
(stainless steel connector)

The mini-implants were inserted into fresh goat mandible without osseous pathology and RFA was carried out using the custom made connector to check its efficiency. The smart peg was finger tightened on the connector (Fig 5) and oriented perpendicular to the bone.Periotest values were recorded as there is high correlation established between RFA and periotest[4].Periotest, was performed and compared with RFA to ensure that the connector does not interfere with the RFA results.[6]



ISQ values as prescribed by Osstell™ Mentor ISQ (Integration Diagnostics AB, Goteborg, Sweden)

FIG 5
(smart peg connector)

The resonance frequency is the peak of the amplitude-frequency plot received from the transducer, and it can be conveniently read on the display of the device. The Osstell TM Mentor transforms resonance frequencies into implant stability quotients from 0 to 100 , with higher values indicating higher stabilities(Fig 5). RFA was performed (Fig 6) parallel and perpendicular to the surface of superficial bone . ISQ values (Fig 7)were measured three times parallel to the superficial cortical fibers of the goat bone and afterward three times perpendicular to it.Similarly,Periotest was also performed in the same directions.For analysis, the arithmetic mean of RFA and periotestvalues of each direction and the overall mean values for micro-implant were calculated.

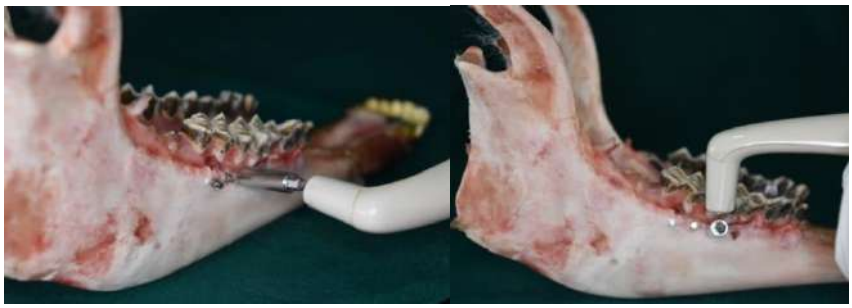


FIG 6
(RFA performed in goat mandible)

FIG 7
(periotest)

STATISTICAL ANALYSIS

The statistical analysis was done using the SPSS software (Version 22)." Data were tabulated in an excel sheet and descriptive statistics (mean,standard deviation) are summarized in table 1. Pearson correlation test between Periotest and RFA showed correlation coefficients of r = - 0.939 (Table 2).

TABLE 1

	V2-RFA HORIZONTAL	V3-RFA VERTICAL	V4-RFA MEAN	V5-PERIOTEST HORIZONTAL	V6-PERIOTEST VERTICAL	V7 – PERIOTEST MEAN
N valid	16	16	16	16	16	16
Missing	3	3	3	3	3	3
Mean	63.25	63.25	63.25	1.50	1.56	1.53
Std.Deviation	10.555	9.983	10.258	2.633	2.190	2.398
Skewness	-1.988	-1.915	-1.960	1.052	0.992	1.050
Std.Errorof skewness	0.564	0.564	0.564	0.564	0.564	0.564
Minimum	35	37	36	-2	-1	-2
Maximum	74	74	74	8	7	8

TABLE 2

		V2-RFA HORIZONTAL	V5-PERIOTEST HORIZONTAL
V2	Pearson correlation	1	-.955**
	Sig.(2-tailed)		.000
	N	16	16
V5	Pearson correlation	-.955**	1
	Sig.(2-tailed)	.000	
	N	16	16

correlation is significant at the 0.01level(2-tailed)

		V3- RFA VERTICAL	V6- PERIOSTAT VERTICAL
V3	Pearson Correlation	1	-.900**
	Sig.(2-tailed)		.000
	N	16	16
V6	Pearson correlation	-.900**	1
	Sig(2-tailed)	.000	
	N	16	16

correlation is significant at the 0.01level(2-tailed)

		V4- RFA MEAN	V7- PERIOTEST MEAN
V3	Pearson Correlation	1	-.939**
	Sig.(2-tailed)		.000
	N	16	16
V6	Pearson correlation	-.939**	1
	Sig(2-tailed)	.000	
	N	16	16

correlation is significant at the 0.01level(2-tailed)

RESULTS

Both RFA using the connector and the periotest device showed uniform results which indicated that the connector did not interfere with the RFA results. The mean ISQ value was 63.25 with a standard error of 10.25. Periotest measurements showed mean values of 1.53 with a standard deviation of 2.39. The differences between the two directions of measurement were statistically significant ($P < 0.001$) for RFA and the Periotest.

DISCUSSION

Treatment success using implants depends mainly on its primary stability. To ensure primary stability of the mini-implants, implant design and insertion protocol are the factors to be considered .Insertion and removal torque are few widely used methods to assess the implant stability. The disadvantage in measuring the insertion and removal torques are that during the healing phase or loading, the stability of the mini-implant is subject to change because of the remodelling processes.[7]Hence,assessing the primary stability in every phase of treatment is important to ensure the longevity and durability of the mini-implants. Resonance frequency analysis is a standard method to assess the implant stability as and when required during the treatment phase hence can be considered superior over the above-mentioned methods. The initial pilot studies regarding RFA for mini-implants used adhesive fixation of a magnet to the mini-implant's head.[8] Uysal T in 2010 [9]modified the mini-implant with an external screw head. The method was reliable for stability measurements yet it had limited clinical efficiency as the design failed to engage attachments for orthodontic tooth movement. Veltri et al[10] in 2009 evaluated the primary stability of three different mini-screws using resonance frequency analysis.The author soldered an abutment on the

mini-implant head and a L-shaped transducer screw was finger tightened on the abutment and oriented with its cantilever beam perpendicular to the bone.The author customized the abutment and the L-shaped transducer. Resonance frequency is the peak of amplitude frequency plot received from the transducer.Seperate modifications of the miniscrew head and customization of the transducer screw were done for measuring the resonance frequency. Effective application of this technique in a clinical scenario is questionable as it is time consuming,technique sensitive and involves complex laboratory procedures. Niekumper et al[6]in 2013 evaluated mini-implant stability using resonance frequency analysis. He used specially designed mini-implants with the head possessing an inner screw thread. The design aided in establishing a stable connection between implant and the tranducer head.Different kinds of connector can be screwed onto the head. Hosein et al in 2019[11]developed an adopter for attachment of Osstell's SmartPeg onto a variety oforthodontic mini-implants. The Mini-implant smart peg adaptor(MISPA)can be secured onto various implant designs by clamping onto the implant head and a smartpeg was attached on top of the MISPA via a screw mechanism. The connecting screw had smart peg threaded on one side inserted through the MISPA device and the other end of the screw contacted the mini-implant head and it was tightened. The study was performed in a synthetic bone block and results were obtained. The measurements obtained from novel mini-implant adaptor agreed with those obtained using a conventional SmartPeg attachment. The main disadvantage with MISPA is that the screw component contacts the implant head which in itself might alter the primary stability. In addition, placing the MISPA device in a patient is technique sensitive and the associated soft tissue factors involved in a patient has a negative influence on the fit and stability of MISPA. Hence, considering the above factors this technique cannot be validated in a day-to-day clinical practice. The main rationale of this study was to interlink the implant head to the smart peg using a connector which by itself should not interfere with the mini-implant stability and to overcome the other disadvantages of previously available connector designs. The study aimed at achieving effective, chair side clinical assessment of primary stability using RFA. The connector was designed for commercially available mini-implants such as Bioray and Dentos and it was custom-made to the diameter of implant for secure coupling to the mini-implant head.The design accepted smart peg threads on one side and snugly fit on the mini-implant head on the other.1.5*8mmBioray and Dentos implants were placed in fresh goat mandible .RFA measurements were made using the Ostell Mentor ™ device with the help of the customized connector. Periotest is efficient in detecting early implant failure.[12,13]There is a high correlation that is established between RFA and Periotest for dental implants.[14,15]Especially in in-vitro, the results are accurate and reliable because of the perfect handpiece angulation.Hence, periotest was also carried out to check the efficieny of the customized connector device. Periotest and RFA measurements were made in both parallel and perpendicular directions and the mean was calculated.The mean ISQ value for RFA 63.25+/-10.25 , and Periotest was 1.53+/-2.39 . The differences between the two directions of measurement were statistically significant ($P < 0.001$) and high correlation($r = -0.939$) was established for RFA and Periotest. The findings of this study suggest the potential to use the novel connector with the Osstell device for clinical assessment of mini-implant stability. Osstell ISQ device can be considered for a routine use in clinical practice. Further studies are required to validate the results for clinical applications.

CONCLUSION

The connector was found to be efficient in measuring the resonance frequency which can be used as routine chair side procedure to assess primary stability. Hence a connector can be customized and manufactured for commercially available implants similar to an implant driver which can effectively aid in measuring the clinical stability. With the results that we achieved on cadaveric goat mandibles, application on human jaws has to be performed to evaluate its clinical benefits.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-31

Twin Block Appliance - A Review

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Abstract: Twin block appliance is mostly used for correction of class II malocclusion part with mandibular skeletal retrusion. This appliance uses the force of occlusion of teeth, the most natural functional mechanism to initiate bone remodelling process for functional correction of malocclusion. Twin block is a functional appliance which is designed to enhance mandibular forward growth in the treatment of distal malocclusion by encouraging a functional displacement of mandibular condylar downward and forward in glenoid fossa. It is composed of distinct upper and lower units which are not joined together. It is efficiently used as it plays a major role in achieving rapid functional correction of malocclusions by transmitting favourable occlusal forces to occlusal inclined planes that cover all posterior teeth. Considerable forces are applied to the muscle of mastication and the teeth. On undergoing this force internal and the external basal bone are severely influenced.

Key words: Class II malocclusion, Magnetic twin block, Inclined plane

INTRODUCTION

The twin block appliance is a two-piece functional appliance. They are bite-blocks that effectively modify the occlusal inclined plane to induce favourably directed occlusal forces by causing a functional mandibular displacement. The appliance was designed to be worn for 24hrs. The Twin block is a smart modification of Schwartz double plate and the split activator. It is a widely accepted and popular functional appliance.

HISTORY

The twin block was initially developed by William Clark for the treatment of class II malocclusions[1]. The day on which it was used was September 7,1977. This appliance came into evolution in response to a clinical problem. A young patient Colin Gove, whose father is a dentist, fell and completely luxated an upper central incisor. Fortunately, he kept the tooth and within few hours of the accident the tooth was reimplanted using temporary splint and later on with stabilizing splint. It is also employed to prevent lip trap and also to prevent direct pressure on upper incisor. This appliance was actually designed to ensure the forward posture of mandible. Repositioning creates a positive proprioceptive response in the muscles of mastication.

PRINCIPLE

It is based on maximising the growth response to functional mandibular protrusion by using this appliance. Considerable forces are applied through the muscles of mastication to the teeth and the underlying bony structures to influence both the internal and the external structure of the basal bone. Unfavourable cuspal contact during distal occlusions replaced by favourable proprioceptive contact on the inclined plane of the twin block to rectify the malocclusion.

ANGULATION

Angulation of the inclined plane is the key factor for the fabrication of the inclined plane[2]. Initially the angulation between the blocks were made at 90 degree. Since it was a quite difficult task to hold the mandible forward at this angle and hence it was modified to 45 degrees. In due course of time the angulation was changed to 70 degrees to the actual plane, in order to apply more horizontal force which in turn encourages more forward mandibular growth.

PHASES OF TREATMENT
ACTIVE PHASE

- Sagittal correction
- Vertical correction
- Correction of occlusion

SUPPORT PHASE

- The purpose of this phase is to retain the corrected incisor relationship until buccal side occlusion is established.
- Upper removeable appliance with steep anterior inclined guide plane.
- Vertical control is essential in support phase after reduction of overbite.

RETENTIVE PHASE

- Treatment is followed by retention of the upper anterior inclined plane appliance.
- Wearing the appliance is reduced to night time wear only after the occlusion is fully established.
- A good buccal segment occlusion is the key factor of stability after correction of arch to arch relationship.

TREATMENT TIME

The treatment time for active phase vary from 6 to 9 months; the treatment time for support phase vary from 3 to 6 months and the treatment time for retentive phase is 9 months.

- The wear time gradually decreases.
- TOTAL TIME = 18 MONTHS (inclusive of all retention period)

DESIGN OF TWIN BLOCK

The earliest twin blocks were designed with the following components:[3] Midline screws to expand the upper arch. Occlusal bite blocks. Adams clasps on upper molars and premolars. Adams clasp on lower premolars. Interdental/ball end clasps on lower incisors. Provides additional retention and are essential if the labial bow is not used. They are placed interdentally. In the maxillary appliance additional ball clasps are placed interdentally distal to canines, or between the premolars or deciduous molars. The mandibular appliance is retained with ball end clasps mesial to canines.

Labial bow to retract the upper incisors

Yaqoob et al[4] in 2012 conducted a randomized controlled trial using Clark's twin block functional appliance with and without an upper labial bow and the results concluded that the addition of a maxillary labial bow to the Clark's Twin Block has no influence on dentoalveolar or skeletal changes, or on rate of overjet reduction, in relation to appliance therapy. Springs to move individual teeth and improve the arch form Provision for extraoral traction in treatment of maxillary protrusion. The delta clasp was designed by Clark in 1985 to enhance the fixation of twin blocks. It is similar in principle to the modified arrow head clasp (Adams 1949) but incorporates new features to improve retention, minimize adjustment and reduce metal fatigue, thereby reducing breakage. The Delta clasp retains the basic shape of the Adams clasp with interdental tags, retentive loops and buccal bridge. The essential difference is in the retentive loops, which are shaped as a closed triangle as opposed to an open V-shaped loop in the Adams clasp. Alternatively, the arrowhead may be circular or ovoid in shape if preferred. The Delta clasp does not open with repeated insertion and removal, and therefore maintains better retention, and requires less adjustment. A further crucial advantage is that the clasp gives excellent retention on lower premolars, and can be used on most posterior teeth.

OCCLUSAL INCLINED PLANE

The occlusal inclined plane is the fundamental functional mechanism of dentition[5]. Occlusal forces transmitted from the dentition will influence the rate of growth and trabecular structure of supporting bone. This sensory feedback mechanism provides a functional stimulus to mandibular bone growth.

BITE REGISTRATION

In a deep bite case blue project gauge is used and bite is registered with an interincisal clearance of 2mm ,5-6mm clearance in interpremolar/deciduous molar region, 1-2mm clearance in the molar region. Bite is opened beyond the freeway space, so that the patient cannot retrude the mandible when in rest position, but the blocks are not made too thick so that the patient can eat and speak comfortably with the appliances in the mouth. In case of an open bite the inter-incisal clearance is maintained at 4mm and the objective is to open the bite beyond freeway space so as to intrude the posterior teeth, without making the blocks too thick.[6]

RESPONSE TO TWIN BLOCK TREATMENT

When the mandible posture is downward and forward there is an area of immense cellular activity above and behind the condyle referred as tension zone[7]. This area is quickly involved by proliferative blood vessels and connective tissue. New position of muscle response will be established where the patient will find it difficult to retract the mandible to the former retruded position. Baccetti et al[8](2000) in a cephalometric study evaluated the optimum treatment timing for twin block treatment. Skeletal maturity in individual patients was assessed on the basis of cervical vertebrae maturation stages. Findings of this study indicated that optimal timing for Twin-block therapy of Class II disharmony is during or slightly after the onset of the pubertal peak in growth velocity. Late twin block therapy lead to enhanced mandibular lengthening and reduced forward displacement of the condyle in favor of effective skeletal changes.

PTERYGOID RESPONSE

After the appliance is given to the patient, it will alter the muscle balance. So that it will become painful for the patient to retract the mandible. This is described as pterygoid response or formation of tension zone distal to condyle[9].

MODIFICATIONS OF TWIN BLOCK

Magnetic twin block[10]

- Usage of magnet in twin block help us to accelerate correction of arch relationships. Types of magnets used

Rare earth magnets are used

- Samarium cobalt
- Neodymium boron

Attracting Magnet

It pulls the appliances together and encourages the patient to occlude activity and consistently in forward position:
Indication: patient with weak musculature.

Repelling magnet

They deliver additional forward mandibular poster without reactivation of blocks.

Twin block hyrax appliance

Transvers development can be combined with mandibular advancement by adding twin block appliance with rapid palatal expansion appliance like hyrax screw.

SKELETAL CHANGES IN TWIN BLOCK THERAPY

- Forward growth or repositioning of the mandible is seen after twin block therapy.
- Increase in SNB angle.
- Little change in SNB angle indicating maxillary restraint but was not detected because of dentoalveolar remodeling disguising skeletal effect.
- Forward growth or repositioning of mandible does result in significant change in ANB thus severity of class II skeletal pattern is reduced.
- Increase in lower anterior facial height.

DENTAL CHANGES

- Overjet reduction.
- Retroclination of upper incisors.
- Proclination of lower incisors.
- Buccal segment correction occurred by distal movement of the upper molars.
- Lower molar eruption is an anterior oral superior direction.

INDICATION

- Permanent dentition and active grower.
- Uncrowded dentition.
- 10 mm or less overjet with normal deep overbite.
- Normal growth direction.
- If patient of class II div 2 with limited overjet or class II div 1 with crowded and irregular incisors, align the upper incisors with a fixed or removable appliance before starting a twin block.

CONTRAINDICATION

- Class II Skeletal by maxillary prognathism.
- Vertically directed grower.
- Labial tipping of lower incisors.
- Crowding.

MODIFICATION
TWIN BLOCK FOR ARCH DEVELOPMENT[11]

- TRANSVERSE DEVELOPMENT
- SAGITTAL DEVELOPMENT
- SAGITTAL AND TRANSVERSE DEVELOPMENT
- TO CLOSE ANTERIOR OPEN BITE

Parkin NA at al[12] in 2001 compared the two modifications of Twin block appliance in Class II samples. The study compared the skeletal and dental changes contributing to Class II correction with 2 modifications of the Twin-block appliance: Twin-block appliances that use a labial bow and Twin-block appliance that incorporate high-pull headgear and torquing spurs on

the maxillary central incisors. Both types of the Twin-block appliance were very effective in correcting Class II malocclusions. Dentoalveolar tipping occurred in both groups and the addition of high-pull headgear to the Twin block allowed effective vertical and sagittal control of the maxilla and, consequently, there was no increase in the LFH/TAFH ratio.

TREATMENT OF CLASS II DIV 2

- Retro inclined upper incisors are responsible for holding the mandible in distal position in angles class II div 2 malocclusion.
- Construction bite is registered with incisors in edge to edge occlusion.
- Vertical development is the primary factor in correction of class II DIV 2 malocclusion with minimum advancement of mandible.
- In class II div 2 malocclusion retruded incisors are the main cause for retruded mandible.
- Retruded incisors are corrected by giving 2/4 appliance.
- The 2/4 is a fixed appliance which is made of bands on first permanent molar and bonded to erupted permanent incisors.
- Thereby correction of retruded incisors will enable the mandible to advance, after twin block appliance is given.

TREATMENT OF CLASS III MALOCCLUSION

- The position of bite blocks re reversed when compared to twin blocks for class II treatment.
- Designed to encourage maxillary development by action of reverse occlusal inclined planes cut at 70 degrees.

Minase et al[13] in 2019 compared the effectiveness of reverse twin block with lip pads-RME and face mask with RME in the early treatment of class III malocclusion. Both groups were effective in correcting the malocclusion, but reverse twin block with lip pads-RME appliance had nonsignificant but greater impact on maxillary advancement and more hold on the posterior positioning of the mandible with minimal dental compensation as compared to Facemask-RME appliance.

TREATMENT OF FACIAL SYMMETRY

- Sagittal twin blocks give better control for the correlation of dental or facial symmetry.

ADULT TREATMENT

- Twin block can be used in mild discrepancies in adult.
- But in severe skeletal discrepancies, twin blocks are contraindicated and orthognathic surgery is a treatment of choice in adult patients.

TWIN BLOCK REACTIVATION

Most functional appliances can only be reactivated by laboratory reconstruction or adjustments, or by time consuming chairside additions of acrylic, with the accompanying risk of loose monomer in the intraoral cavity. A modified twin-block appliance allows controlled, stepwise bite advancements to be carried out easily at the chair. Advancement screws are incorporated in the maxillary appliance blocks and activated by the insertion of cylindrical acetyl. Resin spacers of various thicknesses. Bite reactivations of as much as 7mm can be readily achieved using the standard 12mm advancement screws. For greater activations, the longer 16mm or 20mm screws may be required.[14]

RECENT ADVANCES

Patterson et al[15] in AJODO 2020 evaluated if Class II malocclusion can be treated with clear aligners after completing treatment with the initial set of aligners. Two groups with subjects having Class I and Class II malocclusions were compared. No improvements were observed in AP correction in patients with Class II malocclusion when correction was attempted with Class II elastics along with aligners. The Invisalign system successfully achieved certain tooth movements and improved the total ABO score yet the aligners warranted additional refinements and increased treatment duration.

CONCLUSION

Facial harmony and balance are of equal importance to the dental occlusion. One cannot ignore the importance of Orthopaedic techniques in achieving these goals by growth guidance during the formative years of facial development. The integration of Orthopaedic techniques offers a new initiative in restoring facial balance.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-32

The 2017 Classification Of Periodontal Diseases – Simple Or Complex? – A Questionnaire Survey Among The Post Graduate Students:

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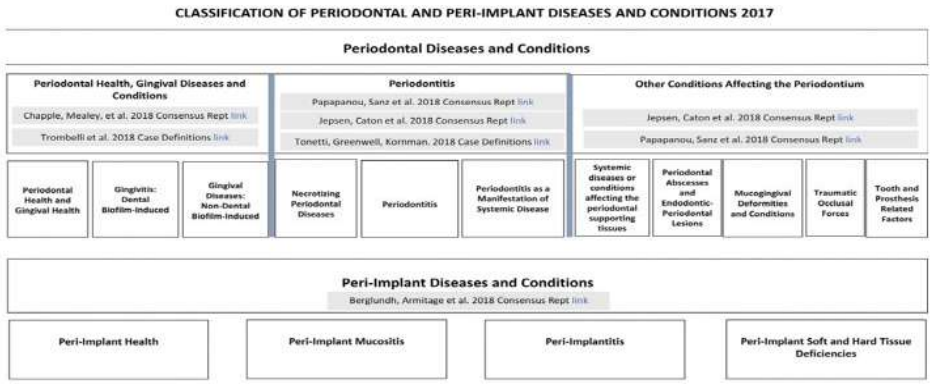
Abstract: Over the decades, various researchers and epidemiologists have done wide work in the development of periodontal diseases classification. They have been great strides towards the understanding of periodontitis but the true nature of etiopathogenesis is still not clear. A consensus report was proposed in 2017 for a new classification system for periodontal and peri implant diseases and conditions. This study aims to shed light on the current understanding of the new classification among Post Graduate students in periodontology department. This survey study was performed using an anonymous digitally distributed google forms to various universities in India. The google form included 12 questions – 9 multiple choice questions with two open ended questions, in addition to demographic data of the participant. Statistical analysis is done by SPSS Software.100 questionnaires was given out and the data was analyzed by SPSS software and the results were procured. Rating of Learning Curve for the New Classification was steep with 68.48% and the p value is <0.001. The only statement the participants disagreed was that the New Classification is easily transformative to Clinic with 47.25%.51.09 % rated the new classification as good. Though it has few limitations, it has many advantages over the older classification. Further revisions to the new classification are needed to facilitate its application in order to confer the greatest benefit to the patient.

Key words: Periodontal, newer classification, AAP, questionnaire survey.

INTRODUCTION

Based on scientific data different periodontal classification systems have been proposed for grouping diseases into distinct categories for many decades [1-3]. The main goal of classification systems is to detect a correct clinical diagnosis and apply the appropriate treatment. For each classification system, a number of studies was done to provide a framework for better understanding of the etiology and pathogenesis of periodontal diseases so as to clear the knowledge gaps. It also helps in communicating with clinicians, researchers, students, epidemiologists and public health workers. This is in addition to encouraging new treatments modalities to evolve which addressed the proposed disease categories. The last time the American Academy of Periodontology (AAP) periodontal classification guidelines were updated was in 1999.Oral health care practitioners have learned that there are multifactorial and multidimensional contributions to periodontal disease. Since the 1999 workshop, new information has emerged from population studies, basic science investigations, and the evidence from prospective studies evaluating environmental and systemic risk factors. The analysis of this evidence has prompted the 2017 workshop to develop a new classification framework for periodontitis. The 1999 International Workshop for Classification of Periodontal Disease and Conditions gives a detailed classification of periodontal conditions. Over 40 gingival diseases were plotted based on two main categories: plaque induced and non plaque induced gingivitis. The other seven main categories of disease includes periodontitis as a manifestation of systemic diseases, chronic periodontitis instead of adult periodontitis, and aggressive periodontitis as a substitute for early onset periodontitis, which was considered umbrella of all former types of periodontitis affecting young patients, namely: juvenile, prepubertal, and rapidly progressive periodontitis[2-6].The 2017 periodontal classification aimed to update the 1999 classification. It was developed in the "World Workshop on The Classification of Periodontal and Periimplant Diseases and Conditions" copresented by the American Academy of Periodontology and the European Federation of Periodontology[1](FIGURE:1). The workshop also developed a new category to include periimplant health and diseases such as periimplant mucositis and peri-implantitis[7]. Applying new knowledge and a new system faces with challenges, which includes the awareness level, the technical difficulties, the feasibility of application, and the size of the gap between theory and practice. Therefore, this study was designed to assess the level of awareness and knowledge of the new periodontal classification among postgraduate students in various universities in India.

FIGURE 1



MATERIALS AND METHOD

This survey study was performed using an anonymous digitally distributed google forms to various universities in India. The google form included 12 questions with 9 multiple choice questions with two open ended questions, in addition to demographic data of the participant (ANNEXURE). The Statistical analysis was done by SPSS Software. The first five statements of the questionnaire were descriptive in nature addressing the participant's demographics, and the 6th to 14th was a question on whether or not the participant was aware of the new periodontal classification. There was 9 multiple choice questions using the Likert scale, ranging from "strongly disagree" to "strongly agree" or from "very steep" to "easy" or from "very long to adequate" and "neutral" .There were also three open ended questions on advantages and limitations of the new classification and further comment at the end of the questionnaire.

STATISTICAL ANALYSIS

Numerical data were presented as frequencies and percentages. Chi square test was performed. Statistical analysis was performed using SPSS software. The significance level was set at $P \leq 0.05$.

RESULTS

The questionnaire was distributed to 100 postgraduate students of periodontology, 92 of whom responded. The present study was conducted on 92 periodontists, 56 of whom were females(60.87%) and 36 males (39.13%)(FIGURE:2).Among the postgraduate students,6 first years(6.67%),36 second years(40%),and 48 third years(48%) responded to the questionnaire.(TABLE :1)(FIGURE:3).

TABLE 1

		N	%	Chi-Square Value	P-Value
Year of Post Graduation	First Year	6	6.67	31.200	<.001
	Second Year	36	40.00		
	Third Year	48	53.33		
Gender	Male	36	39.13	4.348	.037
	Female	56	60.87		

The overall rating of the new classification was good with 51.09%,fair with 34.78% and very good with 14.13%(FIGURE:4,5). Rating of time taken for examination and diagnosis compared to 1999 classification was adequate with 44.57%,very long with 43.48% and neutral with 11.96%(FIGURE:6). Rating of Learning Curve for the New Classification was steep with 68.48%,neutral with 27.17% and easy with 4.35%(FIGURE:7).All these statements were found to be statistically significant with p value < 0.05.(TABLE:2).

TABLE 2

		N	%	Chi-Square Value	P-Value
Rating of New Classification	Fair	32	34.78	18.935	<.001
	Good	47	51.09		
	Very Good	13	14.13		
Rating of time taken for examination and diagnosis compared to 1999 classification	Adequate	41	44.57	18.935	<.001
	Neutral	11	11.96		
	Very Long	40	43.48		
Rating of Learning Curve for the New Classification	Easy	4	4.35	58.326	<.001
	Neutral	25	27.17		
	Steep	63	68.48		

The statement that the New Classification is easily transformative to Clinic was disagreed by 47.25%, agreed by 31.87% and neutral with 20.88% (FIGURE:8). Staging and Grading of Periodontitis is applicable in day to day practice was agreed by 65.93%, and disagreed by 34.07%(FIGURE:9). The single entity as periodontitis simplified the understanding, diagnosis, prognosis and treatment planning was agreed by 58.24% neutral by 28.57% and disagreed by 13.19%(FIGURE:10).The present revision classification completely addresses the drawbacks of 1999 classification was agreed by 68.48%,neutral with 20.65% and disagreed with 10.87%(FIGURE:11). Gingival Classification of Cairo et.al.[8] is better in assessing Mucogingival condition compared to Miller Classification [9] was agreed by 65.22%, neutral with 21.74% and disagreed by 13.04% (FIGURE:12). It is helpful in the prediction of future disease severity was agreed by 57.61%, neutral with 34.78% and disagreed by 7.61% (FIGURE:13).All these statements were found to be statistically significant.(TABLE:3).

TABLE:3

	Disagree		Neutral		Agree		Chi-Square Value	P-Value
	N	%	N	%	N	%		
New Classification is easily transformative to Clinic	43	47.25	19	20.88	29	31.87	9.582	.008
Single Entity simplified understanding, diagnosis, prognosis and treatment planning	12	13.19	26	28.57	53	58.24	28.637	<.001
Staging and Grading of Periodontitis is applicable in day to day practice	31	34.07	0	.00	60	65.93	9.242	.002
The present revision classification completely addresses the drawbacks of 1999 classification	10	10.87	19	20.65	63	68.48	52.457	<.001
Gingival Classification of Cairo et. al. is better in assessing Mucogingival condition compared to Miller Classification	12	13.04	20	21.74	60	65.22	43.130	<.001
It is helpful in the prediction of future disease severity	7	7.61	32	34.78	53	57.61	34.587	<.001

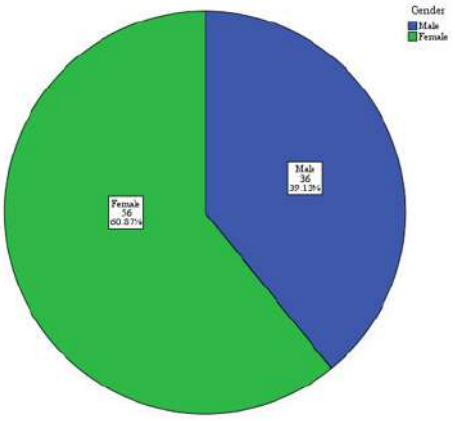


FIGURE 2
Represents the percentage of number of males and females participated in the survey.

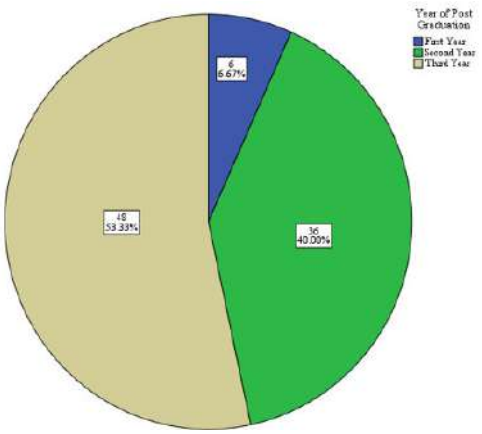


FIGURE 3
Represents the percentage of the number of postgraduate students participated in the survey.

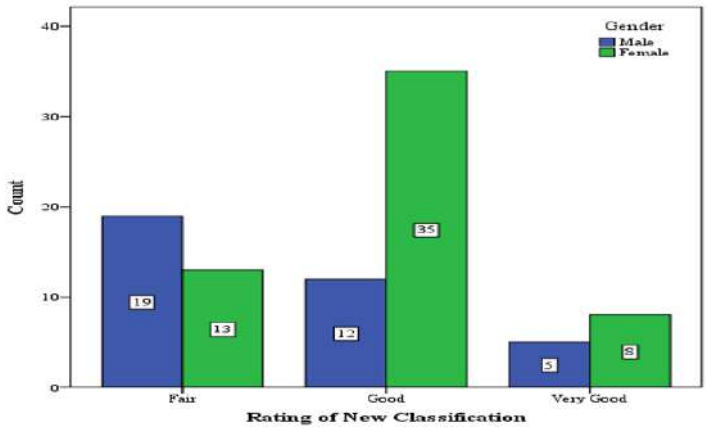


FIGURE 4
Represents the percentage of rating of new classification by the participants in accordance with their gender

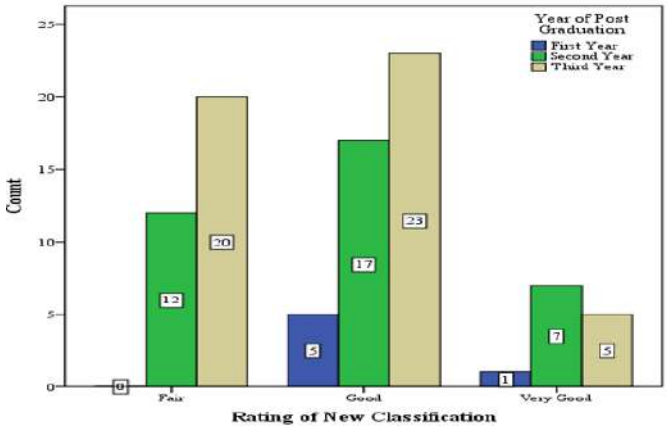


FIGURE 5
Represents the percentage of the rating of new classification by the postgraduate students in accordance with their academic year
R

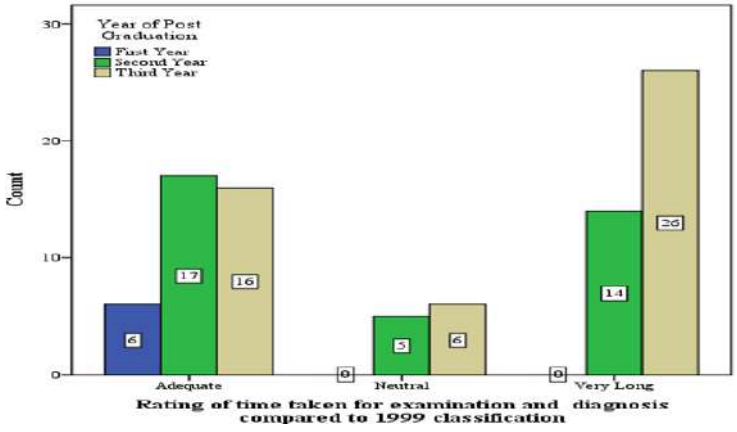


FIGURE 6
Represents the percentage of rate of time taken for examination and diagnosis compared to 1999 classification

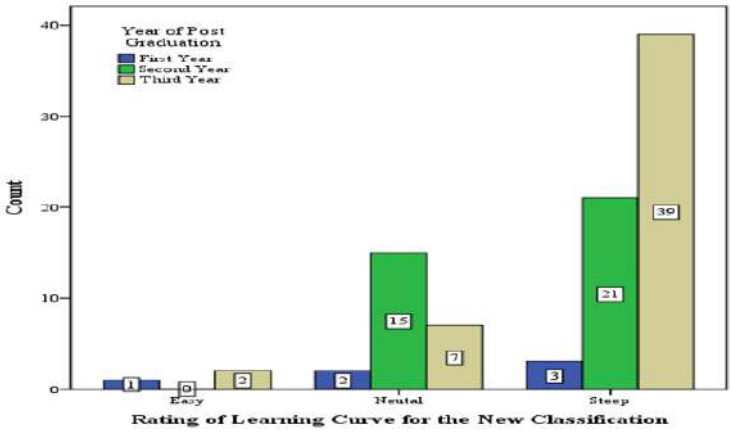


FIGURE 7
Represents the percentage of the rating Learning Curve for the New Classification.

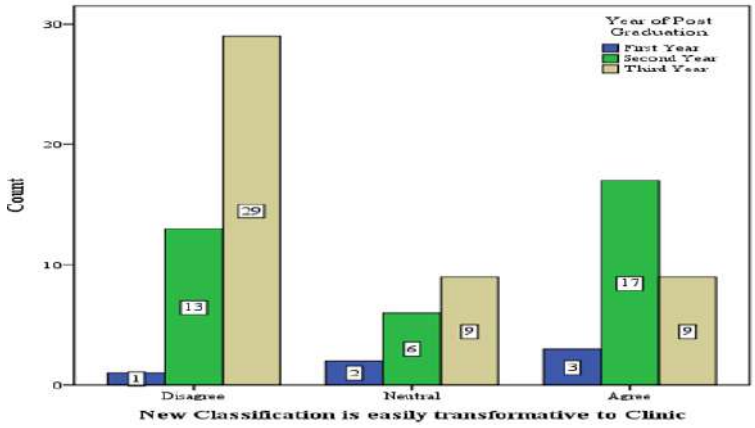


FIGURE 8
Represents the percentage of response to the statement that new classification is easily transformative to clinical practice

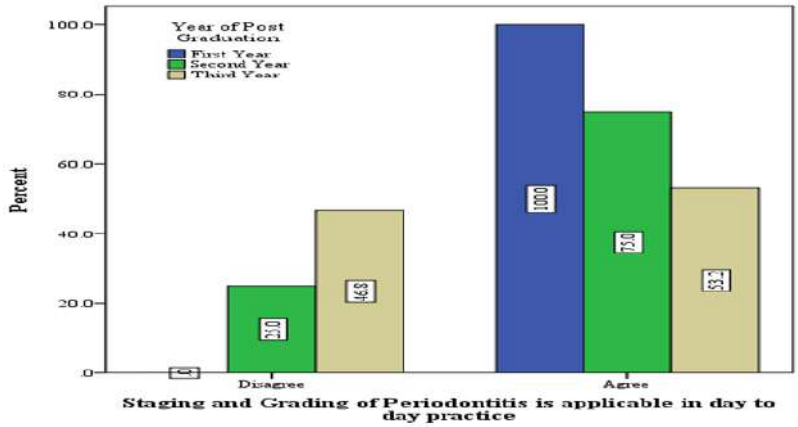


FIGURE 9
Represents the percentage of response to the statement that the staging and grading is applicable in day to day practice

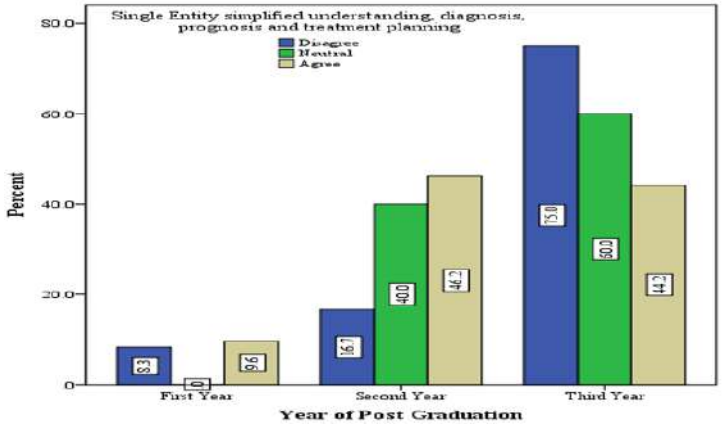


FIGURE 10

Represents the percentage of response to the statement that the single entity of periodontitis simplified the understanding, prognosis and treatment planning

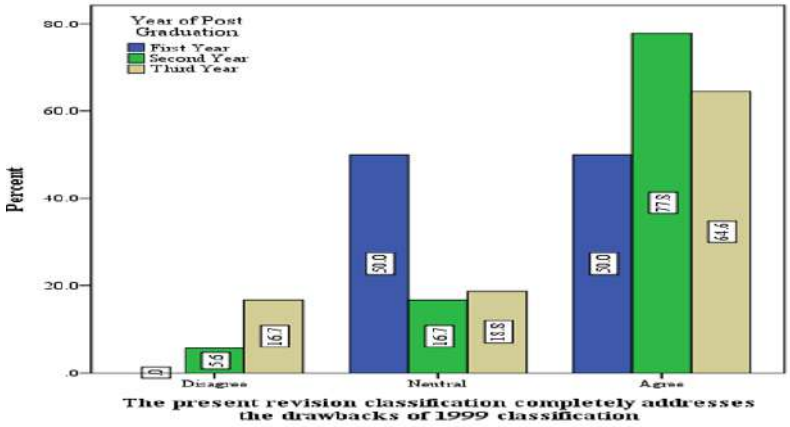


FIGURE 11

Represents the percentage of response to the statement tha the present revision of classification completely addresses the drawbacks of 1999 classification

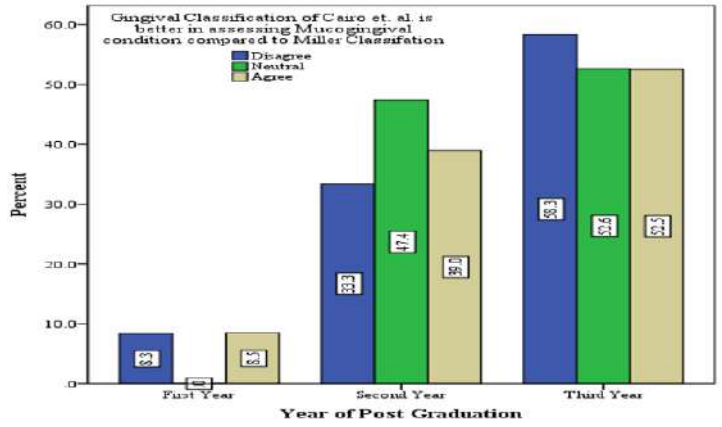


FIGURE 12

Represents the percentage of response to the statement that the cairo et al classification is better in assessing the mucogingival condition than the Millers classification

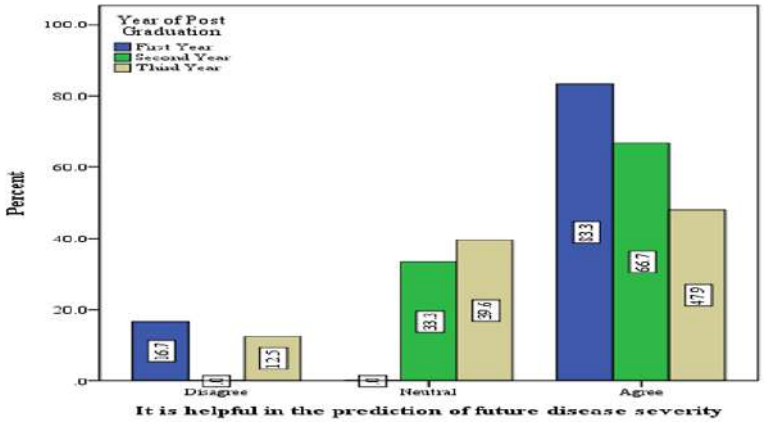


FIGURE 13
Represents the percentage of response to the statement that it is helpful in the prediction of future disease severity

DISCUSSION

Over the decades, various researchers and epidemiologists have done wide work in the development of periodontal diseases classification. They have been great strides towards the understanding of periodontitis but the true nature of etiopathogenesis is not clear. Other classification systems was based on infectious etiology which would be a misfit to the current understanding. Hence a classification system that would be easy to understand and fulfils the treatment needs would be more suitable at this juncture. This article is aimed at discussing the American Academy of Periodontology 1999 classification and present 2017 the World Workshop Classification System. Our survey aimed to assess awareness and clinical application of the new classification among Postgraduate students of periodontology of various universities in India. The questionnaire was distributed to 100 dentists and was completed by 92. This might be due to a lack of motivation, a busy academic life making it difficult to complete volunteer tasks, and perhaps also a lack of clinical application of the new classification by many postgraduate students. The overall rating of the new classification was responded as good by 47 participants with 51.09%, fair by 32 participants with 34.78% and very good by 13 participants with 14.13%. Rating of time taken for examination and diagnosis compared to 1999 classification was responded as adequate by 41 participants with 44.57%,very long by 40 participants with 43.48% and neutral by 11 participants with 11.96%. Rating of Learning Curve for the New Classification was responded steep by 63 participants with 68.48%, neutral by 25 participants with 27.17% and easy by 4 participants with 4.35%. The only statement the participants disagreed was that the New Classification is easily transformative to Clinic with 47.25%. There was two open ended questions about the advantages and limitations of the new classification.14.2% participants stated that the new classification had a good clarity.12% participants stated that the new classification included the peri implant diseases and conditions.4.4% participants stated that the new staging and grading system as an advantage.5.5% participants stated that the cairo et al classification was better in assessing the recession than the millers classification. 12% participants stated that the diagnosis based on the new classification system was expensive because of the need of more radiographs for each diagnosis.14.2% stated that the new classifiction had a steep learning curve.8.8% stated that the time taken for diagnosis based on the new classification was lengthy. Some of the other opinions on new classification was that it provides personalised treatment plan and Replacing aggressive periodontitis with a grading system was disagreed by participants. Marwa M. Hegab et al in 2020 conducted a similar study among periodontists and postgraduate students [10].The questionnaire was manually distributed to 188 dentists and was completed by only 91, giving a response rate of 48.4%. The study concluded that the clarity of the new classification was the only significant predictor with the overall satisfaction rate 28.6%. To the best of our knowledge, this article was the first report in literature addressing the new classification. Although the participants stated some of the limitations in the newer classification, it addresses the drawbacks of the 1999 classification and helps to update our knowledge on understanding the periodontal status of the patient.

CONCLUSIONS

51.09 % rated the new classification as good. Though it has few limitations, it has many advantages over the older classification. Further revisions to the new classification are needed to facilitate its application in order to confer the greatest benefit to the patient.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-33

Oral Microbiome Mirror Of Systemic Health- A Review

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Abstract: Oral microbiota is an important part of the human microbiome. Oral microbes can be colonized into the intestine in various ways. Oral microbiota is associated with a variety of oral diseases. Recently, much evidence has suggested that the oral microbiota is closely related to the physical state of humans, such as diabetes, obesity, and cancer. Shortly perception, oral microbiota will become a new target for improving the systemic health of humans. The oral cavity has the second largest and diverse microbiota after the gut harboring over 700 species of bacteria. It as numerous microorganisms which include bacteria, fungi, viruses and protozoa. The mouth with its various niches is an very complex habitat where microbes colonize the hard surfaces of the teeth and the soft tissues of the oral mucosa. The oral microbiome is crucial in maintaining oral as well as systemic health.. The existence of new genomic technologies which are next-generation sequencing and bioinformatics has given a complete data analysis of complexities of the oral microbiome. It has provided a powerful means of studying the microbiome.

Keywords: oral microbiota, oral health, systemic health.

INTRODUCTION

Human mouth consists of many types of micro-organisms which includes bacteria, viruses, fungi and protozoan. Oral microbiome is unique because of the constant contact of oral cavity with the external environment. Diets, Temperature, pH of saliva are important factors that contribute to the establishment of oral microbiome. The oral microbiome is imperative to health as it causes both oral and systemic diseases. A dysbiosis microflora influences the development of oral diseases like dental caries, periodontal diseases. Promoting a balanced microbiome is the key to maintain or reestablish oral health. Technological advances in the recent times have started to unwind the mysteries and complexities of the oral microbiome helping us to gain insights into its role in health and disease states.[2,3,4]

ORAL MICROBIOMNE AND ORAL HEALTH

The oral microbiota contributes to the health and physiological status of the mouth. The teeth, gingival sulcus, tongue, cheeks, hard and soft palates, and tonsils each provide enriching environments during which microbial can flourish. The oral microbiome is extremely dynamic due to the oral cavity's continuum with the external environment'. The mouth has multiple essential functions that affect bacterial growth and activity: eating, communicating, and defending against infection. Even oral microbial colonies that are less vulnerable to agitation experience changes attributed to diet, age, and health, also as constant changes in pH, redox potential, atmospheric conditions, salinity, and water activity from saliva.[9,10,11]Colonization resistance, Immunomodulatory activity, enhancement of host defenses and host physiology and generation of antibacterial nitric oxide.[1,2,3] The oral cavity has evolved to improve oral health and fosters highly personalized microbiomes that exist dynamically in balance with the host. The symbiotic relationship between host and microbiome maintains microbial homeostasis; however, dysbiosis, a breakdown of the microbial homeostasis, induces oral disease and increases the risk for systemic diseases.[5,6,7] The inseparable relationship between the host and microbiome is formed over a long time by facing various changes that force the adaptation of the oral microbiome to the new environment. A bidirectional relation is characterized by the microbe providing the host with abilities it lacks alone, while the host provides an appropriate environment for microbial growth. The host factors can positively affect the microbiome, making balance and diversity between the species, thus inducing symbiosis and an absence of pathology.[3,4,5] On the contrary, the host can also create a negative influence. This co-evolution between the host and microbiome succeeded in achieving a complex biological process in which the existence of independent entities would be impossible. The mutual benefits from the maintenance of a balanced host–oral microbiome ecology can be distorted to induce a shift from a healthy and symbiotic relation to a pathologic and dysbiosis one. This distortion can result from changes in the oral microbiome as well as in the host. Even though the host and the microbiome are equivalent factors, early studies have focused on finding the pathological oral microbiome, and the role of the host in maintaining a healthy oral microbiome was overlooked.[19,20] The recent research studies have moved to focus on the host factors and the role of host–oral microbiome in the development of a healthy and balanced oral ecology, and extended to systemic disease and oral disease. The oral microbiome interaction is connected with a variety of oral diseases. Many studies have proven that oral microbiome and gut microbiome are similar so it plays an important role in physiological status of health.[17,18] Host Factors to Modulate the Oral Microbiome.

Factor Reference

Genetics

Genetic polymorphism in miRNA202 is involved in hBD1 salivary level as well as caries experience.

Genes expressed in dental enamel development are associated with molar–incisor hypomineralization GLUT2 and TAS1R2 genotypes individually and in combination are associated with caries risk

- Host genetic control of the oral microbiome in health and disease .
- Microbial abundance and some aspects of the microbial population structure are influenced by heritable traits in saliva.

Immunity[5,6]
- Immune cell network mediating immune surveillance at oral mucosa and gingiva
- The innate host response in caries and periodontitis
- Secretory immunity with special reference to the oral cavity

Attachment surface[1,2,3]
Surface properties influence oral biofilm formation. Differences in relation to the microbial diversity of modified resins during the initial phase of biofilm maturation - Biomaterial-associated infection of implants and devices .

Diet - Vegan diet influences on the human salivary microbiota. Short- and medium-chain fatty acids exhibit antimicrobial activity for oral microorganisms.

Cigarette
Smoking- decreases structural and functional resilience in the subgingival ecosystem .Firmicutes were statistically elevated in smokers at the expense of Proteobacteria and Fusobacteria in non-smokers.Tobacco smoking affects the salivary gram-positive bacterial population.[4,5]

Alcohol - Alcohol affects to the oral microbiome composition

Oral hygiene - Toothbrushing frequency is related to the incidence and increment of dental caries

Socioeconomic status

Socioeconomic factors, such as education and income, are associated with disparities in the prevalence and severity of periodontal disease. A strong association between cariogenic bacteria and socioeconomic status was found. Differences in socioeconomic status were reflected in the bacterial profile of saliva.[1,2,3] With various "omics" studies, information on the composition of oral microbiomes is available. This vast amount of oral microbiome data, which were procured via HMP, could be the fundamental basis of clinical applications including early diagnosis, predictive treatment, and prevention. The general microbial screening for diagnosis is performed using saliva and site-specific screening with gingival crevicular fluid and dental biofilm. Saliva is a useful diagnostic fluid, providing the overall microbiome and proteome or metabolomic data from bacterial metabolic or host inflammatory products for personalized monitoring.[7,8,9] This combined information from saliva can be used to predict susceptibility to oral diseases, including dental caries or periodontitis, with higher specificity. Microbial screening of the mouth can be applied not only with oral diseases, but also with systemic diseases due to their reciprocal association.[10,11]

Oral Disease and Systemic Disease
The commensal microbiome plays an important role in maintaining oral and systemic health. The breakdown of the microbial balance induces oral pathologic conditions suchas periodontal disease, dental caries, and endodontic disease, which are associated with systemic diseases including diabetes, cardiovascular disease (CVD), respiratory disease, and cancer. The links between oral diseases and systemic health are complicated and bidirectional in many ways. Among many oral diseases, periodontitis has a close relationship with non-communicable diseases (NCDs); particularly, diabetes and CVD. When periodontitis is left untreated, it could lead to the loss of periodontal supporting tissue due to microbial infection. Oral pathologic microbiomes could release virulence factors, inducing an inflammatory response, and invade the body through pathogenic lesions, which increases the risk of exacerbating NCDs.[4,5,6]

Potential Clinical Application of Oral Microbiomes
With various "omics" studies, on specific oral microbiomes present in the ofral cavity is available. This vast amount of oral microbiome data, which were procured could be the fundamental basis of clinical applications including early diagnosis, predictive treatment, and prevention.[11,12] The general microbial screening for diagnosis performed using saliva and site-specific screening with gingival crevicular fluid and dental biofilm. Saliva is a useful diagnostic fluid, providing the overall microbiome proteome or metabolomic data from bacterial metabolic or host inflammatory products for personalized screening. This combined information from saliva can be used to predict susceptibility to oral diseases, including dental caries or periodontitis, with higher specificity. Microbial screening of the mouth can be applied not only with diseases, but also with systemic diseases due to their bidirectional association.[16,17,18]

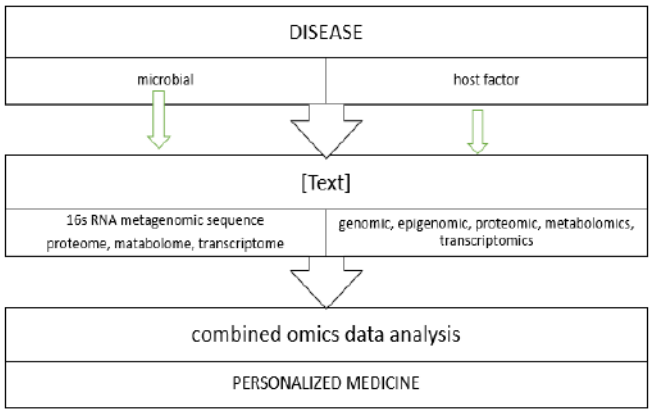
DISCUSSION

Oral and systemic link
The commensal microbiome plays an important role in maintaining oral and health. The breakdown of the microbial balance induces oral pathologic conditions such as periodontal disease, dental caries, and endodontic disease, which are associated with systemic diseases including diabetes, cardiovascular disease (CVD), respiratory disease, and cancer.[5] The links between oral diseases and systemic health is complicated and bidirectional in many ways. Among many oral diseases, periodontitis has a

close relationship with non-communicable diseases; particularly, diabetes and CVD. When periodontitis is left untreated, it could lead to the loss periodontal supporting tissue due to microbial infection.[12,13,14,15] Oral pathologic microbiomes could release virulence factors, inducing an inflammatory response, and invade the body through pathogenic lesions, which increases the risk of exacerbating of the disease.[7]

Future perspective

The knowledge about oral microbiomes research is in new directions, and extended analysis of transcript (transcriptome), protein (proteome), and metabolic products provides insight into host–microbial interaction in oral and systemic diseases. The current state of this oral microbiome which has been reported so far, shows that oral diseases are complex components and host immune responses, and are interrelated with systemic health. The combined study with multi-omics data from a host their microbiome will facilitate advances in personalized medicine.



CONCLUSION

The microbiome should not be underestimated since it serves as a key determinant of health and disease. In this review, we have discussed how oral microbiota affects systemic health. Many studies suggest that the oral microbiota can affect oral diseases and affect the health of the whole body. In the future perspective according to the microbiome affected we can prescribe target therapy and precision treatment in all the disease. Still wide knowledge and many studies have to be carried out in Indian population. Exploring specific microbes in our population is required to achieve a successful oral and systemic health.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-34

A Brief Review on Healing Of Extraction Sockets with And Without Regenerative Materials

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Abstract: Tooth loss is one of the major problems that is prevalent worldwide since the tooth place a major role in the masticatory function thus aiding in digestion. Tooth can be extracted or removed for various reasons such as caries, periodontitis, fractures etc. The lost tooth should always be replaced so that the functions become normal. The process of extraction generally results in resorption of the bony sockets during the healing period. Hence to restore the lost teeth the bone should be in a proper condition. This review provides an insight on a technique called as socket preservation and the materials which have been used for this process and their mechanism in healing of extraction sockets.

Keywords: Socket Healing, Bone Substitutes, Platelet Concentrates

INTRODUCTION

We know that a lot of essential functions are dependent on the teeth. The teeth are mainly responsible for mastication. Also, the teeth affect our ability to speak and so on. But the teeth are generally more prone to infection and are extracted easily. The indications for extractions are due to many reasons. Sometimes it is necessary because of pain, infection, bone loss or fracture of the tooth. Infection or disease. The bony socket of the teeth often gets damaged when an infection or disease occurs resulting in the resorption of the underlying bone. That is the extraction of teeth produces many defects on the surrounding bone, gums and shrink them and the bone recedes quickly causing defects on lips and cheeks. The loss of alveolar bone may be attributed to a variety of factors, such as endodontic pathology, periodontitis, facial trauma, and aggressive procedures during extractions. These defects in the jaw will cause problems while restoring with either implants, dentures, or bridges. The deformities produced by tooth extraction can be prevented and repaired by the socket preservation. This review is aimed to give an insight on the materials used for socket preservation and their role in healing.

BIOLOGY OF WOUND HEALING AFTER EXTRACTION

After the extraction of tooth, a series of events takes place inside a socket. This healing process after extraction involves certain vascular alterations; inflammatory activation; migration, proliferation, and differentiation of different cell populations; production of extracellular matrix and its maturation; formation remodeling and modeling of bone helping in the restoration of the lost tissues. It mainly comprises of:

1. Coagulation and haemostasis, which immediately follows the teeth extraction.
2. Inflammation, that is initiated shortly thereafter.
3. Proliferation, initiated in the subsequent days and incorporating most of the healing process.
4. Modeling and remodeling of the alveolar bone, aiming to restore the lost architecture and functionality, and lasting for several months.

Haemostasis and coagulation

The first step of haemostasis is when blood vessels constrict to restrict the blood flow. In the next process the platelets stick together to seal the break in the wall of the blood vessel. Finally, coagulation occurs and reinforces the platelet plug with threads of fibrin which are like a molecular binding agent.

The second phase

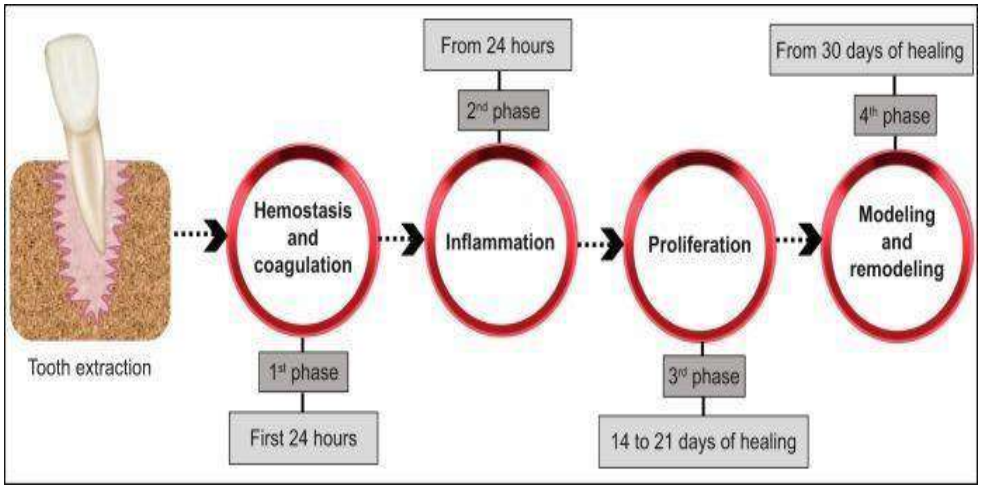
The inflammatory phase occurs for about 3-5 days after tooth extraction. This phase is characterized by formation of a fibrin plug by aggregation of the circulating platelets which is represented by vasoconstriction of the injured vasculature. This creates the stage for the formation of a provisional matrix which occurs by haemostasis.[1] When haemostasis is established, the plasma from the blood and other mediators of healing pass through the walls of the vessels since the vascular permeability is altered. This process is called as diapedesis. Swelling, redness, heat and pain are represented as the important clinical features in this phase.

The third phase

The third phase is the proliferative phase. This phase occurs for about 14 days postoperatively. This phase comprises of the formation of pink granulation tissue which consists of inflammatory cells and collagen secretion-epithelization, pink color of the tissue and the formation of scar are main clinical manifestations. Excessive collagen formation and scar contracture.

Last Phase

The last phase of socket healing is remodeling phase. It occurs for 6 weeks postoperatively. The main objective for remodeling phaseis to replace weaker typeIIcollagen. This process is called matrix degradation. This is continued by matrix formation which involves the replacement with stronger type I collagen. The matrix metalloproteinases and the serine proteases regulate the collagen fibers and the extracellular matrix of the scar. Clinically this represents a normal tissue color and scar formation.[2] The process of matrix degradation should equal matrix formation which when not equal results in keloid scar or wound dehiscence.



[pc:de Sousa Gomes P, Daugela P, Poskevicius L, Mariano L, Fernandes MH. Molecular and cellular aspects of socket healing in the absence and presence of graft materials and autologous platelet concentrates: A focused review. Journal of oral & maxilla facial research.2019Jul;10(3)]

PRESERVATION OF EXTRACTION SOCKET WITH BONEGRAFT

Ridge preservation, or socket preservation involves placement of graft material within the socket, which may be further combined with a membrane, or rotated flap. The graft materials when they are positioned inside a fresh socket promote the healing process by assisting in the clot stabilization by acting as solid scaffolds.[3] The application of ridge preservation techniques at fresh extractions sites is performed so as to enhance the standard and maximize the number of bone for the location and osseointegration of an implant , and to avoid post extraction alterations of the ridge profile.[4]The biological mechanism for grafting of bone inside the socket is based on: Osteo conduction:It is the process where the bone graft material acts as a scaffold for the formation of new bone which is perpetuated by the native bone.

Osteoinduction

It is the process in which the OPG cells are stimulated to get differentiated into osteoblasts to lay down new bone. BMPs are the most widely studied osteo inductive cell mediators.

Osteogenesis

The bone graft material with this property will have osteoinductive and osteoconductive properties along with the presence of vital osteoblasts that contributes one wboneformation.

Osteopromotion

The materials will promote the osteoinduction even though they do not possess the osteoinductive property. For example, enamel matrix derivative reinforces the osteo inductive effect of demineralized freeze-dried bone allograft (DFDBA) but will not stimulate bone growth alone.

MATERIALS FOR BONE TISSUE SUBSTITUTIONS

The osteoplastic materials can be divided as

Autogenic (the donor is the patient),allogenic(the donor is another person),xenogenic (the donor is an animal) and synthetic (based on calcium salts). There are many different techniques for augmentation by using any of the following :• Bone fillers: freeze-dried bone allograft (FDBA), organic cancellous porcine bone xenograft (CPB), calcium sulfate (CS), magnesium-enriched hydroxyapatite;• collagen sponges: absorbable collagen sponge; : bioabsorbable polylactide-polyglycolide acid sponge (BAS)• recombinant human bone morphogenicprotein-2 growth factor;• membranes: nonabsorbable expanded tetrafluoroethylene membrane (NAM) and bioabsorbable membrane made up of glycolide and lactide polymers (BAM).Synthetic resorbable materials were meant as an affordable substitute for natural bone. artificial graft materials embrace numerous styles of ceramics: tricalcium phosphate; bio glass; hydroxyapatite and its compositions with scleroprote in, sulfated glycosaminoglycans like keratan and chondroitin sulfate similarly like sulphate and orthophosphate. Now, many alternative

sorts of porous nanostructured orthophosphate ceramics, bone cements, biohybrids and biocomposite compounds are created.[5,6]

SOCKET HEALING WITH GRAFT MATERIALS

Ridge preservation, or socket preservation involves placement of graft material at intervals the socket, which may be any combined with a membrane, or turned flap. The principle for socket preservation is sustained for the very fact that, once positioned within the recent socket, graft materials act as solid scaffolds that assist on clot stabilization. These materials could also be broadly categorized into slow and fast resorbing grafts. In the slow resorbing category, graft materials maintain their presence and integrity over the future, and graft particles essentially Osseo integrate and have direct contact with newly formed bone. Fast-resorbing materials, work by the degradation of the bone through the osteoclastic -mediation which in turn enhances the process of osteogenesis.[7] The production of extra cellular matrix and its maturation may be enhanced by certain bone graft materials by their direct modulatory effects. The clinical advantages of placement of bone particles in the extraction socket, aiming to preserve the alveolar ridge so that avoiding the bone grafting procedure prior or during implant placement, are largely supported by the available literature and upto date meta-analyticalstudies.[8,9] In the earliest stages of socket healing, xenogenic mineralized grafting materials bio ceramics or seem to interfere. with the degradation of clot and substitution by mature bone tissue or being non resorbable even for long term . Accordingly, residual and/or encapsulated graft particles were found to range from 0% - within fast resorbing materials (e.g., polylactide sponge),[10] to 45,8% - within cortico cancellous xenogenic grafts .[11] The graft particles will have an immediate contact with the mineralised tissue and that they will represent small areas of decalcification on their outer surfaces. future reports addressing residual grafting of dense hydroxyapatite revealed a remaining volume of around 38%, 20 years following the procedure, with direct bone contact and absence of gaps or fibrous tissues at the bone-biomaterial interface .[12] The assessment of DBBM resorption for long term analyses at 8months, 2 years and 10 years showed a high integration with new bone with the presence of slow biodegradation which provides a good scaffold for bone deposition and a good support for future implant placement.[13] Thus, though there were certain hindrances on the initial phases of socket healing the process of socket preservation seems to be very effective in providing a good formation of matured bone thus promoting the preservation of the alveolar ridge which is being limited by physiologic resorption. This technique majorly has a role in preserving mid-buccal or mid-lingual height.

SOCKET HEALING WITH AUTOLOGOUS PLATELET CONCENTRATES

Along with the use of autogenous, allogenic, xenogenic and alloplastic materials, the autologous platelet [APCs] concentrates are found to be promoting the healing of the sockets.[14]APCs refer to a group of products that promotes the regeneration of the tissues which are obtained from the autologous blood .They provide highly concentrated bioactive factors by triggering the natural healing.[15]

The APCs are classified majorly as

1.Pure platelet-rich plasma (P-PRP),
2. Leukocyte- and platelet-rich plasma (LPRP),
3.Pureplatelet-richfibrin (P-PRF),and
4. Leukocyte-and platelet-rich fibrin(L-PRF).[16]

Different preparation protocols, composition, biological content, and potential application are there for different families of platelet concentrates. The APCs will release certain cytokines and growth factors which are attributed to their beneficial effects in socket healing to promote osteoid formation these are immersed in the fibrin mesh ,platelets and leukocytes.[17] The APCs are available either as liquid solutions or in an activated gel form.[16] The growth factors are generally released within 24 hours of preparation. After the platelet activation L-PRP and P-PRP form loose fibrin meshwork. In contrast, fibrin polymerizes in P-PRF and L-PRF, releases a strong and dense fibrin network for continuous release of the growth factors by trapping the cells, up to 28 days upon application.[18]Fibrinmatrix is described as a favorable scaffold for mesenchymal stem cells proliferation, differentiation, vascular in growth and is safe to be left exposed in mouth to guide the migration of the epithelial cells to its surface, resulting in natural wound re-epithelization by secondary intention healing. Multiple studies have found that when compared to regular blood clot formation there is much promising results for the usage of APCs in case of extraction sockets preservation. The idea of using platelet supplementation to reinforce extraction wound healing is based on the ability of the platelets to trigger healing response upon release of varied growth factors. Platelet growth factors, like the FGF and TGFβ -1, stimulate bone formation during osseous healing. PDGF regulates the migration and proliferation of mesenchymal stem cells within the extraction site and stimulates proliferation of the endothelial, fibroblastic, and osteoblastic cells to stimulate socket healing. Additionally, VEGF, released from platelets, stimulates the proliferation and differentiation of various cell types essential for vascular formation during angiogenesis and vasculogenesis, helping to move nutrients and oxygen mandatory for the extraction wound healing process. The APCs that contain leukocytes are found to reduce the infection -related complications such as dry sockets after mandibular 3rd molar extractions. Monocytes, within L-PRP and L-PRF delivered to the alveolar socket, get differentiated into tissue macrophages. Macrophages function as the key mediators of the wound healing process, which plays an important role in the transition between the inflammatory and repair phase of the wound healing, with particular emphasis on osteogenesis. Macrophage release TGF which in turn stimulate keratinocytes, IL-1, FGF, and TNFα that play a role in collagen production by the fibroblasts and improve the process of angiogenesis. PDGF, can also be produced by macrophages .[19] Socket preservation procedure demands slow resorption and adequate space maintaining biomaterials to stabilize the clot and counteract the post extraction resorption of the ridges. APCs are considered as a weak osteoconductive scaffold and aren't expected to function an osteoconductive biomaterial for ridge preservation alone, in contrastTo slow resorption xenografts, allografts, or alloplasts,are used specifically within socket preservation for therapeutic approaches.

TECHNIQUE TO PRESERVE THE BONE AFTER TOOTH EXTRACTION

After the removal of the hopeless tooth the socket is filled with bone or bone substitute. It is then covered with gum, artificial membrane, or tissue stimulating proteins to encourage the body's ability to repair the socket. With this method of preservation, the healing of the socket will take place without shrinkage and collapse of the surrounding gums and facial tissues. With this method, the socket heals eliminating the post-surgical shrinkage and collapse of surrounding gum and facial tissues. The newly formed bone within the socket also provides a foundation for an implant to replace the lost tooth.[20]

DISCUSSION

The main goal of socket preservation procedures is to preserve the volume of the bone by filling the sockets with bone material substitutes. The process of socket preservation after extraction is found to reduce the healing time[21]. Fotek[22] et al in 2009 conducted a study among 20 patients where test group 1 had their sockets filled with solved preserved mineralized cancellous bone covered with acellular dermal matrix and test group 2 had their sockets filled with solved preserved mineralized cancellous bone d-PTFE membrane and concluded that all sites evaluated showed minimal ridge alterations, with no statistical difference between the two treatment modalities with respect to bone composition and horizontal and vertical bone loss, indicating that both membranes are suitable for alveolar ridge augmentation .Eric Todd Scheyer[23] et al in 2016 conducted a study Forty subjects with extraction sockets Treatments were demineralized allograft plus reconstituted and cross-linked collagen membrane (DFDBA + RECXC) or deproteinized bovine bone mineral with collagen plus native, bilayer collagen membrane (DBBMC + NBCM). Socket dimensions were recorded at baseline and 6 months. Wound closure and soft tissue inflammation were followed post-operatively, and biopsies were retrieved for histomorphometric analysis at 6 months and concluded that DBBMC + NBCM provided better soft tissue healing and ridge preservation for implant placement. Deeper extraction sockets with higher and more intact bony walls responded more favorably to ridge preservation therapy. Thus, socket preservation is better than not preserving them.

CONCLUSION

Thus, the normal process of wound healing that occurs in the extraction sockets are about to produce ridge resorption and bone resorption. The use of different bone graft materials or the usage of the platelet concentrates in the preservation of the extraction sockets provides better post operative results which can be of greater importance for the placement of implants in the future replacing the lost tooth.

CONFLICT OF INTEREST

Conflict of interest declare none.

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SP-35

The Evaluation of Knowledge of Undergraduate Dental Students Regarding the Preference for Complete Denture Characterization.

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Abstract: Patients with completely edentulous upper and lower arches require more attention to fulfill their requirements regarding aesthetics and the natural appearance of a denture. However, the undergraduate dental students have limited or no knowledge about the characterization of complete denture. This cross-sectional study aimed to assess dental students' knowledge and education regarding their preference for denture characterization. The majority of undergraduate dental students from second-to-fourth year registered at ABSMIDS dental college from 2016 to 2018 at Nitte University were invited to participate in this study. A structured questionnaire, which included ten basic questions about denture characterization, was prepared each question provided with four different options. The Questionnaire was given to 100 undergraduate dental students and data was obtained. The questionnaire findings were formulated in pie charts and graphical representations. The findings indicate that students care for gingival appearance, to follow the patient's preference regarding denture appearance, for marginal gingival contouring are generally favorable. Students understood the importance of aesthetics and the natural appearance of a denture. It is necessary to gain more knowledge at an undergraduate level about denture characterization which, is an important step that enhances the aesthetics in a complete denture. These findings are important for institutions to implement or refine in the undergraduate dental curriculum.

Keywords: Characterization, Denture Esthetics, Questionnaire, Dental Students.

INTRODUCTION

Partial or total loss of teeth is a major public health problem. The number of edentulous patients increased day by day because of the loss of teeth due to caries, trauma, periodontitis, attrition, abrasion, etc. The loss of dentition has a major psychological impact on many patients as their aesthetics are compromised. oral health plays a major role in a subject's socializing and dentofacial self-pride. Patients with completely edentulous upper and lower arches require more attention to fulfill their requirements regarding aesthetics and the natural appearance of the denture. Hence characterization of the denture is done to accomplish this harmony. Characterization of the denture base is a denture base colored in such a way that it imitates the appearance of natural oral tissues concerning color and shade.[1] Various methods have been implemented for the reproduction of gingival characterization in artificial dentures .[2,3] Altering the position and size of teeth, according to the patient's age, creates harmony and natural appearance in the complete denture. Whereas soft tissue characterization involves altering the contour of gingival level, creating root morphology, providing gingival pigmentation, etc. However, due to an abundant number of completely edentulous arch patients, with their increased demand for a natural appearance, it is necessary for a dentist who graduates from the dental school to be trained in the theory and the practice of teeth setting successfully along with the knowledge of denture characterization procedure.[4-6] Most of the times the dentist may be able to give almost identical and satisfying complete dentures to their patients. The level of education, age and sex are known to have an effect on the person's satisfaction with his or her oral appearance. [4] It is the responsibility of the dentist to inform the patient that his or her complete dentures can be characterized to suit better appearance. [7-10] An operator can take the liberty to arrange the teeth in an esthetic and acceptable form this will have a positive effect on the patients' self-esteem. Since esthetics is an essential aspect in dental practice, the aim of the present survey is to evaluate knowledge of undergraduate students regarding their preference for complete denture characterization.

MATERIALS AND METHODS

Participants

This was a cross-sectional study that involved a combination of knowledge and awareness of undergraduate students during their training period at the university of Nitte, A. B. Shetty dental college in 2017/2018 towards denture characterization. Dental students from the first year to the final year were invited to participate in the study. This analysis used a 10-item questionnaire distributed to 100 undergraduate students of the above dental school. The questions focused on different

esthetic factors involving the characterization of complete denture. The questionnaire consisted of four measures to pool the questions.

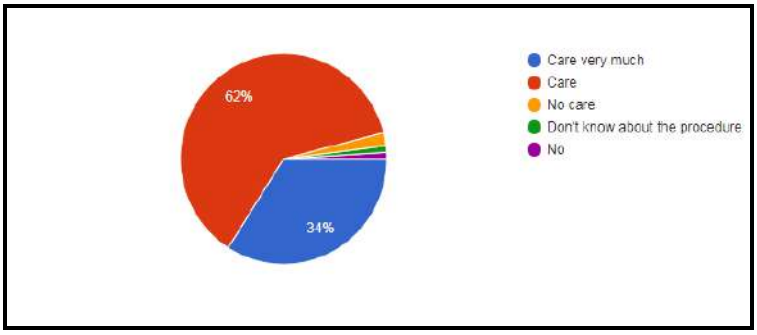
1. Care very much
2. Care
3. No care
4. Don't know about the procedure

The student was made aware of the purpose of the study in advance and were asked to complete the questionnaire, they were questioned on the importance of gingival appearance, marginal gingival contouring, appearance of the roots, gingival stippling, gingival zenith level, carving of the palatal rugae in waxed complete denture and patient's preference regarding denture appearance, tooth characterization according to the personality of the patient and the necessity for gingival pigmentation for more natural appearance of the denture. The data obtained from these questionnaires were assimilated and studied. Data analysis was conducted using SPSS software.

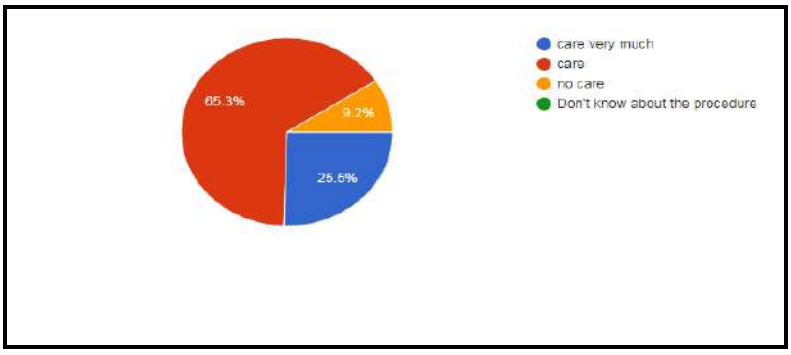
RESULTS

The questionnaires were completed by all the 100 students. The results of the present study were formulated using pie charts and graphical presentations in Microsoft excel sheet, using the acquired data as follows-

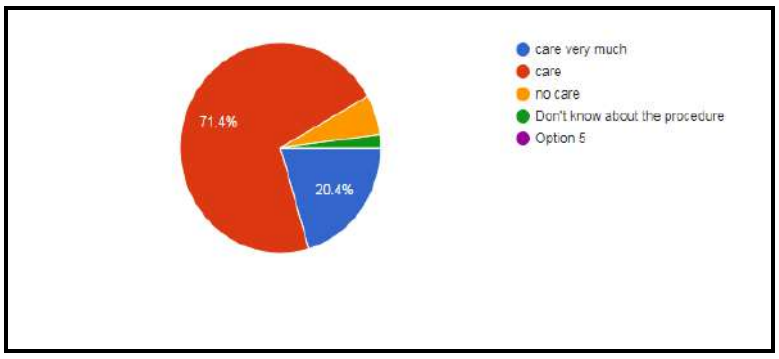
1) Do you care about gingival appearance in complete denture? Figure1



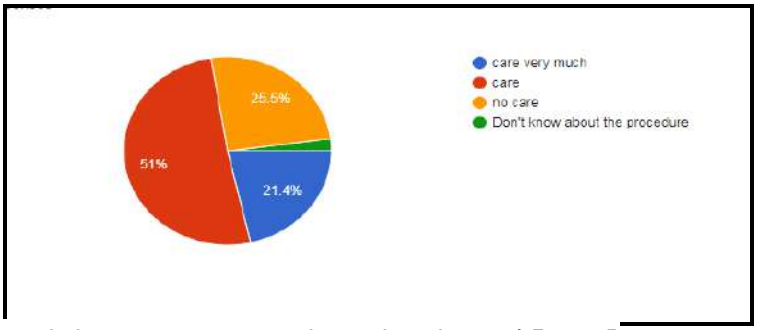
2) Do you care to follow patient's preference regarding denture appearance? Figure 2.



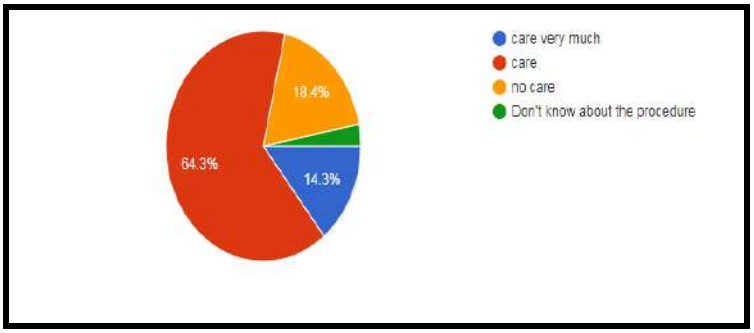
3) Do you care about marginal gingival contouring in waxed complete denture? Figure 3



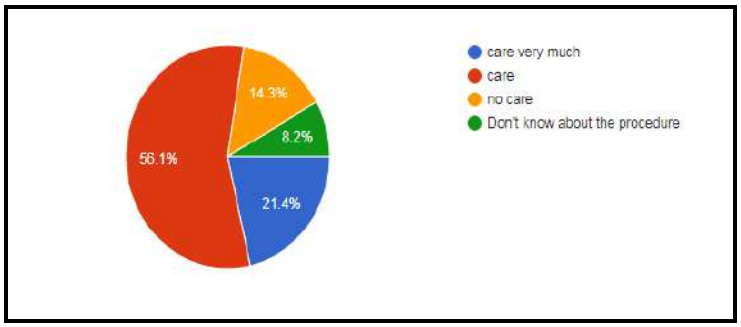
4) Do you care about carving the appearance of roots in waxed complete denture? Figure 4



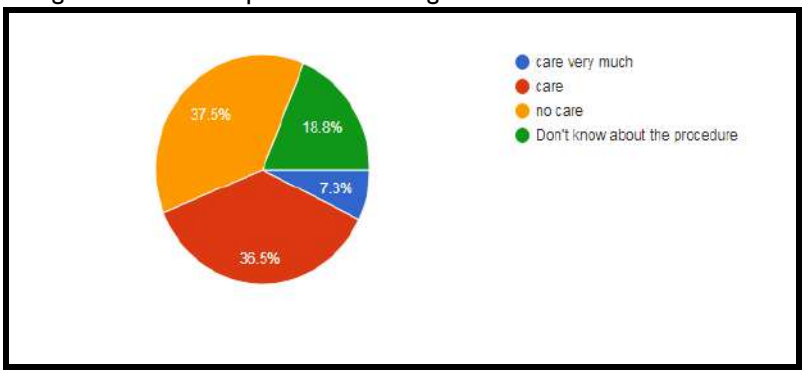
5) Do you care to give gingival stippled appearance in waxed complete denture? Figure 5



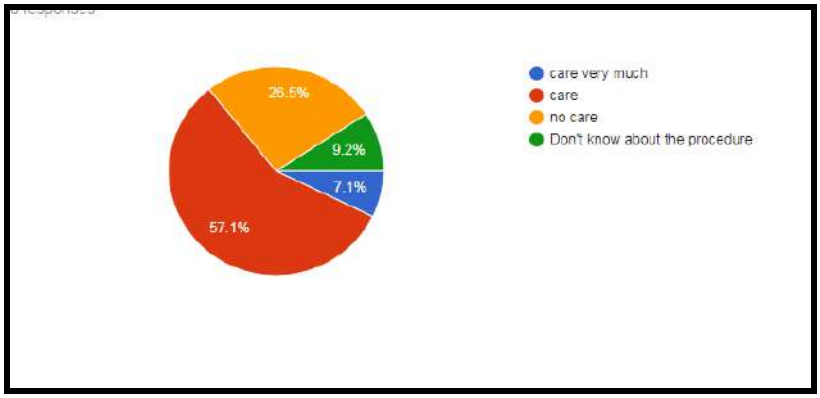
6) Do you care about gingival zenith level while carving the waxed complete denture? Figure 6



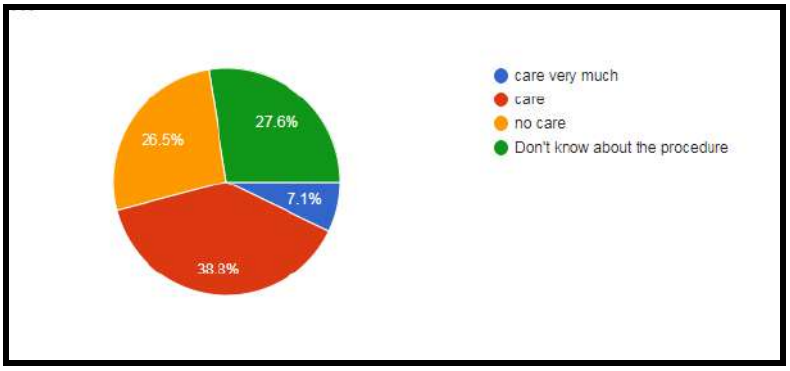
7) Do you care to carve palatal rugae in waxed complete denture? Figure 7



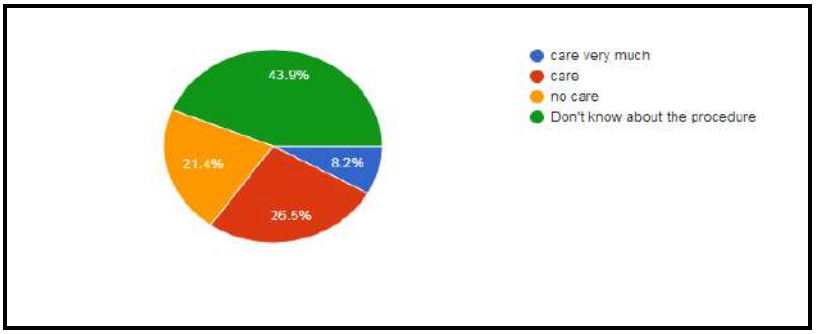
8) Do you care to give gingival contouring according to the age of patient? Figure 8



9) Do you care to give tooth characterization according to personality of the patient?
Figure 9



10) Do you care to give gingival pigmentation for natural appearance of complete denture? Figure 10



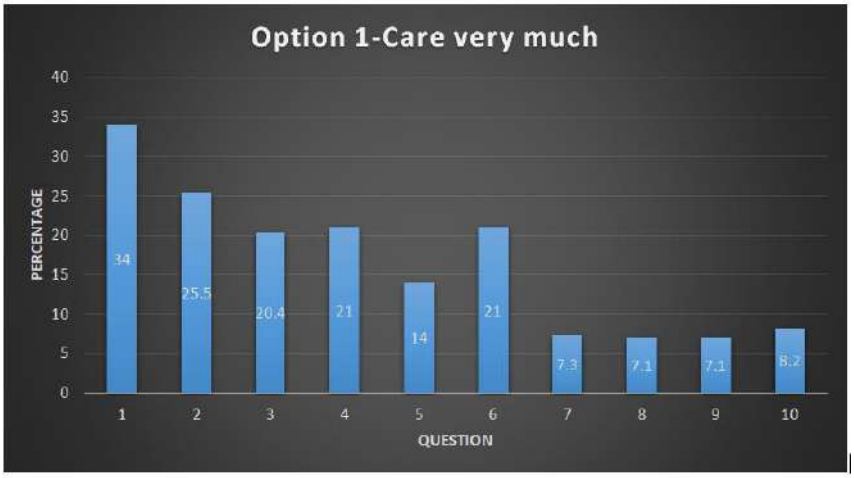


Figure 11

Figure12

Figure 13

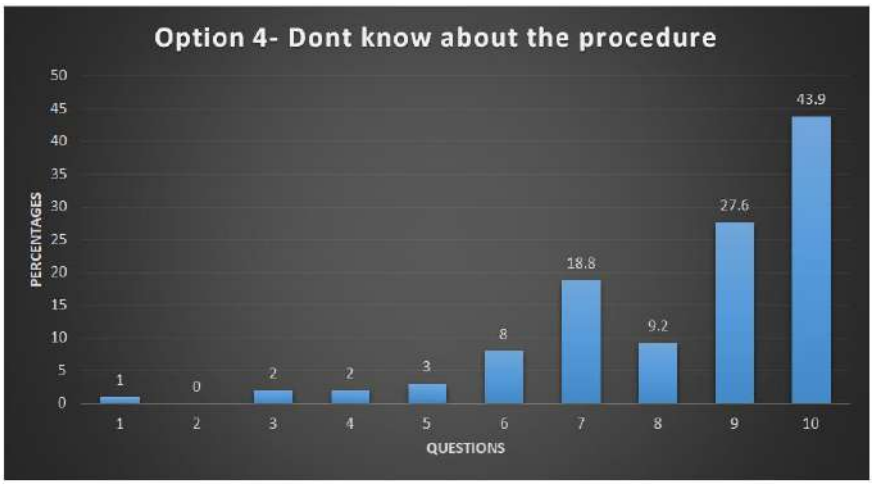


Figure 14

DISCUSSION

Denture esthetics is a combination of art and science in prosthodontics. It is the effect produced by a denture that improves the looks of the patient Attitudes and perceptions toward dental appearance differ among populations and among individuals in a population. [5,6] The present study includes data submitted by 100 undergraduates who completed a questionnaire consisting of different factors for the characterization of complete denture. From the study, it was identified that 62% of the students care for gingival appearance in complete denture whereas 34% of students have given extra attention to gingival appearance. As in the edentulous patients, denture characterization is the only way to represent the aesthetics of gingiva and teeth. This extra

attention would help in enhancing the personality of the patient (fig 1). Understanding the patient's perspective about denture appearance helps in fulfilling his or her needs regarding appearance. Incorporating such a few suggestions in the trial stage helps to boost the patient's confidence. 65.5% of students care to follow a patient's preference regarding denture appearance, 25.5% of students give extra attention to follow the patient's preference regarding complete denture appearance. 9.2% of students did not care about the patient's preference (fig 2). The reflection of inflamed or bulbous gingiva can also be reproduced by leaving more interdental and marginal wax. This creates a more natural appearance in the complete denture. 71.4% of students care for marginal gingival contouring and 20.4% care very much. 6% of students did not care about marginal gingival contouring (fig 3). Carving the appearance of roots in waxed complete denture creates a more natural-looking denture rather than the flat labial surface of the denture. In maxillary denture, the canine eminence is most marked. Lateral incisor eminence is small. According to the present study, 51% of the students care for the appearance of the roots and 21.4% of students care very much about root appearance. 2% of students did not know about the procedure (fig 4). According to Suresh Nayar and Nicholas et al gingival stippling is a characteristic feature of the healthy attached gingiva. [7] Copying gingival texture contributes to the natural appearance of labial flanges in the complete denture. 14.3% of the population care very much about stippling, 64.3% of students care to give the appearance of stippling and 18.4% of students did not care about gingival stippling in the complete denture (fig 5). Gingival zenith level of an individual tooth plays an important in appearance in the complete denture. Each tooth zenith level is different from others. This harmonious arrangement of zenith creates a more natural appearance in the complete denture. In the present study 21.4% students care very much to follow gingival zenith level in the waxed complete denture, 14.3% of students did not care to follow gingival zenith level (fig 6). According to Frush and Fisher's age, gender and personality can be used as a guideline for tooth selection and characterization to enhance the natural appearance of the individual. As age advances, more amount of gingival recession can be seen in patients. 51% of students care to follow age criteria to give the natural appearance in patients, whereas 26.5% of students did not care to follow gingival contouring according to the age of the patient (fig 8). Tooth characterization can be achieved in a waxed complete denture according to the personality of the patient. Prominent line angles denote aggressive personality whereas rounded line angles denote mild personality of the patients. 38% of the study students care to follow tooth characterization whereas 26.5% of students did not care to follow this criterion. 27.6% of the students do not know about the procedure of tooth characterization (fig 9). Gingival pigmentation also plays a major role in denture appearance. To achieve the maximum desired result, these criteria can be followed. 43.9% of students did not know about the procedure which is carried out to reproduce gingival pigmentation. 26.5% of students care to follow this criterion. 21% of study students did not care about gingival pigmentation (fig 10). In the present survey study the frequency of usage of option "care" in all the questions than the option "care very much" (fig 11 and 12). The option "don't know about the procedure" was least frequently selected by the participants (fig 14).

CONCLUSION

Denture characterization is the most important step, which enhances the aesthetics and fulfills the expectations of the patient. Hence it is absolutely necessary to gain more knowledge at an undergraduate level about both tooth characterization and soft tissue characterization to fulfill patient's requirements about natural denture appearance.

From the conducted survey, the following conclusions can be drawn-

1. 65% of students care to follow a patient's preference for denture esthetics whereas 9% of students did not care about the patient's preference.
2. More than 50% of students care about esthetic factors such as marginal gingival contouring, the appearance of roots, gingival stippling appearance and gingival zenith level in the complete denture.
3. 27% of students did not care to give tooth characterization according to the personality of the patient.
4. 49% of students are unaware of the characterization procedure of gingival tissue whereas 21% of students did not care to follow the procedure

CONFLICT OF INTEREST

Conflict of interest declare none.

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SP-36

Porphyromonas Levii: A Missing Link In Periodontitis

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Abstract: The presence of flora on the tooth surface poses a serious hazard to one's health. It causes dental caries by eroding the enamel and Periodontitis by producing a biofilm. In the oral cavity, more than 2000 species are thought to exist. Because all flora cannot be cultivated via plating or other readily available methods, genetic tools must be used. Biofilm production appears to be an important opportunity for these oral infections, according to current findings. Metagenomic approaches necessitate more careful selection and assessment of sample variety, and obtaining the necessary nucleic acid from the sample is difficult.

Keywords: Metagenomics, Periodontal disease, Polymicrobial Biofilm, Dental plaque,Oral microbiome.

INTRODUCTION

The oral cavity is made up of a complex system of tissues and organs that work together to provide a human with many functions[1,2]. Mucosae and teeth, in particular, constitute two key sites for microbial colonisation. Oral cavity infections have well-known systemic consequences. Oral diseases affect nearly 2 billion people, according to studies. It has also long been known that various bacteria are common in specific medical conditions, offering the door to understanding the link between floral identification, count, or pattern and specific diseases[3,4]. Biofilm production appears to be an important opportunity for these oral infections, according to current findings. As a result, the microbial makeup in various clinical circumstances is unknown. Because most bacteria are uncultivable, traditional microbiological methods are currently ineffective. It is contrasting to the traditional genomic segment in many ways[5] Leucocytes are continually patrolling the periodontium, on the other hand.Infection occurs despite this defence system[6], indicating that leucocyte secretions and cellular recognitions are ineffective[7]. While it may not be able to evaluate all genes and link them to oral flora, one element that could have a role is the HLA antigen. Furthermore, if a correlation exists between HLA and periodontal flora, the clinician can adapt the treatment technique accordingly, leading to a better prognosis[8,9]. Our dental cavities are home to a slew of microorganisms, one of which, Porphyromonas levii, is of particular interest since it can be utilised to treat a variety of diseases. A bunch of Micro-organisms inhabit our oral cavities, out of which, Porphyromonas levii is of interest due to the fact that it can be used as a therapeutic mean for the Oral microbiome[10] The majority of species previously categorised as Bacteroides have been reassigned into new genera. Bacteroides levii[11]. This species shares a high degree of similarity with members of the genus Porphyromonas[12] based on biochemical, chemical, and comparative 16s rRNA sequence analysis. As a result, Bacteroides levii (Holdeman, Cato, and Moore) was reclassified as Porphyromonas levii comb. now under the genus Porphyromonas[13]. Porphyromonas levii is a Gram-negative, anaerobic bacterium from the Porphyromonas genus that was isolated from the rumen of a bovine[14]

DESCRIPTION OF ORGANISM

SCIENTIFIC CLASSIFICATION

DOMAIN: Bacteria
PHYLUM:Bacteroidetes
CLASS:Bacteroidia
ORDER:Bacteroidales
FAMILY:Porphyromonadaceae
GENUS:Porphyromonas
SPECIES: P. levii
BINOMIAL NAME: Porphyromonas levii (Johnson and Holdeman 1983) Shah et al 1995

TYPE STRAIN

ACM 5042, ATCC 29147, CCUG 21027, CCUG 34320, HAMBI 467, JCM 13866, LEV, Lev 1, NCTC 11028, VPI 10450, VPI 3300

SYNONYMS

Bacteroide melaninogenicus subsp.levi, Bacteroides levii Gram-negative, obligately anaerobic, nonsporeforming, nonmotile rods or coccobacilli. Cells in broth are 0.5 to 1 by 2 to 5 pm. Cells from solid media are coccobacilli or short rods. Colonies on blood agar plates are smooth, shiny, convex, and 1 to 2 mm in diameter and darken from the edge of the colony toward the

center between 4 and 8 days. Protoheme is the major porphyrin produced, but traces of protoporphyrin also occur. Succinate stimulates growth and can replace the requirement for protohaem. Most other commonly occurring sugars such as arabinose, cellobiose, maltose, melezitose, melibiose, raffinose, rhamnose, ribose, salicin, sucrose, trehalose, and xylose are not fermented. Growth is markedly affected fected by the presence of protein hydrolysates such as trypticase, proteose peptone, and yeast extract[15]. Some amino acids such asparagine, tryptophan, and phenylalanine and glutamine are utilized[16]

METAGENOMICS: AN OVER VIEW

Despite efforts to uncover the links between bacteria and human health[17,] , little is known about the species and functions of the microbial community linked to oral disorders.[18] Large efforts have been made to characterise the composition of the human microbiome at various body regions in order to increase our understanding of the interactions between bacteria and human hosts.[19,20,21,22,23,24] Gram-negative Periodontal infections such as Porphyromonas gingivalis, Treponema denticola, and Tannerella forsythia are frequently isolated from tooth plaques in periodontal patients and were once thought to be distinct periodontal pathogens[25]. Following that, researchers discovered a substantial link between the quantities of various cultivable bacteria (such as Prevotella intermedia, Fusobacterium nucleatum, Selenomonas noxia, Actinobacillus actinomycetemcomitans, and Eubacterium nodatum) and periodontal disease[26,27,28,29,30] There have been no studies that have examined the functional differential between oral microbiomes in healthy people and periodontal disease patients. The genetic content and functional potential of a microbial community can be screened via metagenomic sequencing. Many molecular biological techniques, such as Restriction Fragment Length Polymorphism (RFLP), Random Amplified Polymorphic DNA Fingerprinting (RPAD), Denaturing Gradient Gel Electrophoresis (DGGE), Quantitative Real-time Polymerase Chain Reaction (qPCR), and others, have been used in the last two decades to identify and classify uncultivable oral microbial species[31,32,33]. Recently, next generation sequence technologies (NGS) have enabled the investigation of a large number of microorganisms in various environments without the need for bacterial culture. Using DNA sequencing to investigate various environmental niches, many novel microbe species have been discovered. To examine uncultivated oral microbial populations, two basic DNA sequencing methodologies have been extensively used: 16S rRNA sequence analysis and metagenomics[34,35,36,37,38,39,40,41].

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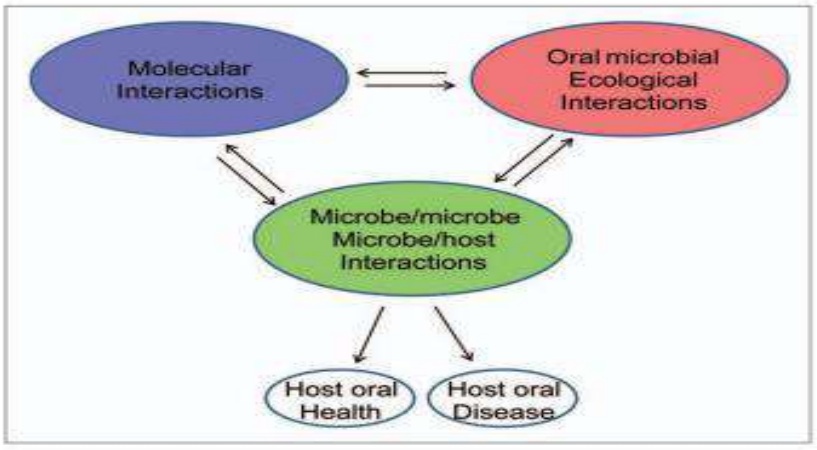


AIMS AND OBJECTIVES

- To find a missing link of Organism- **Porphyromonas levii in Periodontitis.**
- To elaborate on the incidence and prevalence of cultivable and non-cultivable flora in the sub gingival plaque samples in Indian population
- To associate pathogens with chronic and aggressive periodontitis.

METHODOLOGY

Study type: Cross sectional study

- **Group I:** Aggressive periodontitis
- **Group II**: Chronic periodontitis
- **Group III:** Healthy subjects with absence of periodontitis

• **Sample:** Sub gingival plaque

➢ SUBJECT SELECTION

Inclusion criteria

- Aggressive periodontitis patient
- Clinical finding with greater than 4mm of pocket depth
- Radiographic findings with arc shaped bone loss in incisors and molar
- Chronic periodontitis patients.

- Clinical findings with greater than 4mm of pocket depth

Exclusion criteria

- Antibiotic therapy within the past 3 months
- Pregnant women
- Systemically unhealthy
- Smokers

SAMPLE COLLECTION

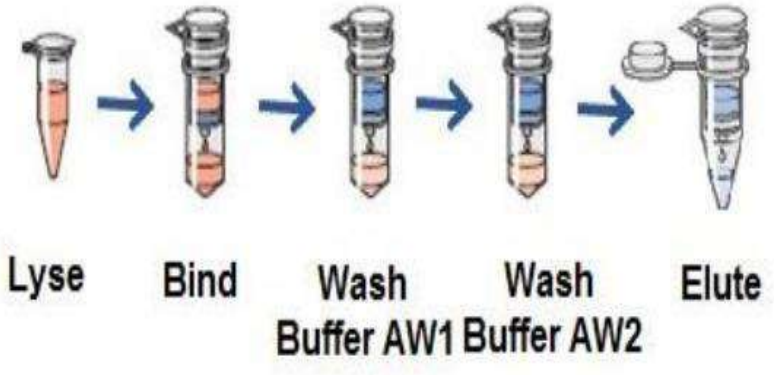
Patients who reported to the OP of Periodontics department were taken for the study. After careful subtraction of supragingival plaque with sterile cotton roll, subgingival plaque will be composed from deep sites in each quadrant using a sterile gracey curette. The subgingival plaque will be assembled in a 9 sterile eppendorf tube covering 1ml of phosphate buffered saline.

DNA EXTRACTION

The DNA was removed from subgingival plaque samples using DNeasy Blood and Tissue Kit. The removed DNA was enumerated using Qubit 4 Fluorometer.

PROCEDURE

The collected samples in the Eppendorf tubes were mixed well by inversion and gentle shaking for a few seconds, after which the samples were incubated at 50^0 C in a water bath for a minimum 15 -20 minutes. After incubation the centrifugation of the cells at 5000 x g (7500 rpm) was done for 10 min and the supernatant was rejected. The pellet was suspended into 180µl buffer ATL and added 20µl proteinase K and mixed thoroughly by vortexing.



DNA Quantification

The extracted DNA was quantified using Qubit 4 Fluorometer

16S rRNA PCR

A PCR targeting 16S rRNA gene was performed for the three different saliva samples with 25µL reaction volume consisting of broad-range pan 16S rRNA primers.

16S rRNA PCR amplicon Purification

All the three saliva samples 16S rRNA PCR amplicons were purified using FavorPrep PCR Purification Mini Kit (Favorgen, Taiwan) and after the purification, amplicons was quantified using Qubit 4 Fluorometer for Nanopore library preparation.

16S rRNA sequencing using Oxford Nanopore Technologies

Sequencing was done by third-generation sequencing technology, Oxford Nanopore Technologies (ONT).

16S rRNAamplicon library preparation and sequencing

Briefly, 1 µg of 16S rRNA PCR product was used for the end repair process with NEBNext Ultra II End-repair/dA-tailing (New England Biolabs, USA).

Preprocessing of16S rRNA Metagenome Sequencing Data

The Fast5 output sequences from the MinION sequencer were basecalled and Demultiplexed using Albacore Softwarev2.0.1 and basecalled Fast5 sequences were converted to Fasta files using Poretools Software v0.5.1.

Taxonomy Assignment by MG-RAST analysis

The 16S rRNA processed reads were finally analysed by using MG-RAST server - a metagenomics analysing server

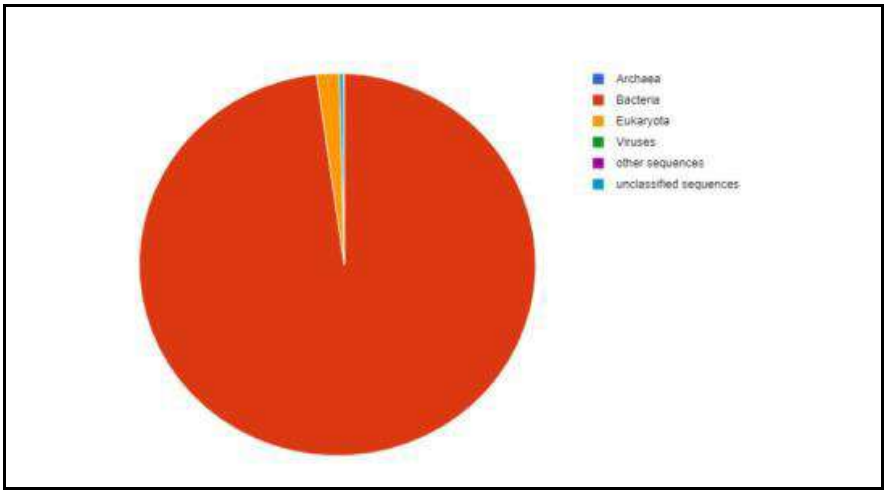
HLA typing

HLA typing of 10 samples was done using whole blood by complete locus sequencing by NGS.

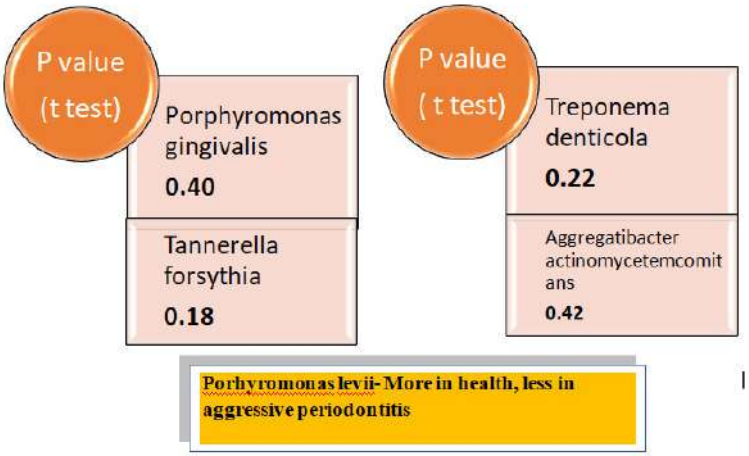
DNA extraction

The DNA was extracted from 10 whole blood samples by using QIAamp® Blood Mini Kit . The quality and quantity of the extracted DNA was analysed using NanoDrop.

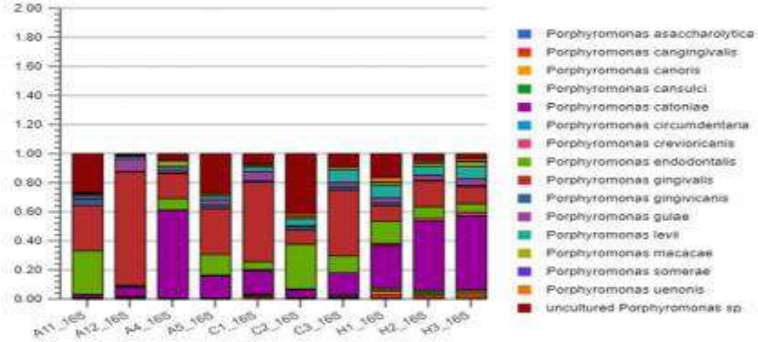
RESULTS



The use of metagenomics to the oral microbiome is still in its early stages. However, metagenomics can examine and compare both bacterial and genomic profiles to investigate relationships between microbial diversity, genetic variations, and oral diseases. The oral microbiome appears to be extremely complicated, according to current evidence. The impacts of the microbiome on the host have an impact on oral health and illness. To understand the complex interactions between the microbiome and the host, a way for a better understanding of oral disease. A variety of organisms were detectedand the bacteria in the red complex did not differ significantly between patients with chronic and severe periodontitis..



Novel organism- Porphyromonas levii was found This shows us that, it can be used as probiotics which modify the course of the disease and shift the balance to the favorable side



DISCUSSION

Metagenomics studies have been conducted in a variety of countries and ethnic groups, and a number of publications have been published as a result. This research is one of the first in the field of Indian population. The Indian populace is projected to enter a new era of periodontal microbiology as a result of this. Aa was discovered in over 50% of the sites in a research by daSilva-Boghossian et al., (2011), but the red complex was found in only around 35% of the sites in Aggressive and Chronic Periodontitis individuals, respectively. Based on literature relating to cultivation and cultivation independent methods of bacterial identification in the oral cavity, Parahitiyava et al., (2010) investigated the oral bacterial flora. They claim that approaches based on culture underestimate the floral population and do not provide adequate information on aetiology and prognosis. In the identification of novel bacterial species, culture-independent approaches were more sensitive. The microbial aetiology and host response in aggressive periodontitis were reviewed by Nibali (2015). "Proven risk variables are only recognised in a limited percentage of AgP cases," they say. They believe that genetically driven dysbiotic alterations in the subgingival microbiota may indicate a susceptibility to fast periodontal tissue loss. In a "comparative genomic analysis" of the known red complex species**,** Endo et al., (2014) discovered novel interactions. They propose various interactions between the species in question, as well as a wide range of specific virulence factors. As a result, they recommend that a new mechanism of floral symbiosis in periodontitis be discovered. Both competitive and cooperative interactions are present in these processes. Uncultured bacteria have been linked to periodontal disease since 1980, according to Socransky et al. They have outlined some of the challenges that microbiologists encounter while studying periodontal pathogens, including difficulty with culturing, the complexity of the microbiota, the identification of distinct diseases as the same, and the possibility of many diseases within a single individual. Despite the fact that none of the difficulties they listed have been solved to date, a short list of infections has been developed, and patients are being treated. In such a situation, metagenomics has shown to be a godsend in determining the causal link.

CONCLUSION

Metagenomics research has been carried out in a variety of countries and ethnic groups, resulting in a number of publications. This is one of the first studies of its kind in the field of Indian population. As a result, the Indian population is expected to enter a new era of periodontal microbiology. Bacteria made up 98 percent of microorganisms, while viruses and fungi made up the rest, according to the data[42,43,44] In summary, To amplify the whole 16S rRNA, researchers used third-generation Oxford nanopore technology. In this approach, the most recent study is likely to offer further insight on the situation. Commensals that have been identified in either human or animal habitats[45] and their pathogenesis involvement appears to be opportunistic. In the future, Periodontologists will need to combine metagenomic data with biochemical pathways to arrive at a dysbiota formula. When it comes to the most commonly implicated species, Porphyromonas Levii is shown to be more in good health and less in aggressive periodontitis[46,47]. Coming to the overall picture of microbial population, as discussed earlier, it is the dysbiota that contributes to the periodontal disease. From statistical analysis of entire data, it was evident that amongst species that were significantly different in chronic presentation and healthy individuals, all were higher in healthy patients, indicating their role in Probiotics or normal microbiome[48,49,50] Newer bacteria are continuously being found, and their impact on periodontal therapy could be significant. Some of the flora, such as Porphyromonas levii, which was discovered in this study, can be employed as Probiotics, which can affect the course of the disease and tilt the scales in your favour. This organism is discovered to be a causal factor in many other ailments such as bovine interdigital infections and vulvovaginitis. More research and investigations are needed to better understand the role of P.levii in the oral cavity and periodontal diseases.

CONFLICT OF INTEREST

Conflict of interest declare none.

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SP-37

Hepatoprotective Effect Of Infliximab Against Hepatotoxicdrugs (Paracetamol, Methotrexate And Carbon Tetrachloride)

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Abstract: Liver is a versatile organ which performs multiple functions.The gastrointestinal homeostasis and body function in general is maintained by the liver.The liver injury occurs when the parent compound is metabolized into highly active metabolites which combinewith the macromolecules that include proteins, lipidsand nucleic acids with the resultant loss of cellular integrity and dysfunction.Consequently, it is not surprising that liver diseases are the major cause for morbidity and mortality.Tumor Necrosis Factor (TNF)is the vital mediator ofpatho- physiological conditions leading to hepatocellular damage and activation of HSC and extracellular matrix deposition the hallmarks of liver fibrosis, TNF not only is an inducer of hepatocellular damage, but also as a pro-fibrogenic factor in the liver. Hepatotoxic drugs target the liver cells, alter the metabolic pathway and hinder normal function by causing destruction or degeneration of hepatic cells. Hepatotoxic drugs mainly activate TNF. The toxicity induced by Paracetamol, Methotrexate and Carbon tetrachloride, the resultant hepatocellular damage envisaged by these drugs and the role anti -TNF antibody infliximab as a hepatoprotective drug is illustrated in the present review.

Keywords: Hepatotoxicity, Paracetamol, Methotrexate, Carbon Tetrachloride,Tnfα, Infliximab

1. INTRODUCTION

Liver, the largest organ of the body, present below the diaphragm on the upper right quadrant of the abdomenis four lobed wedge- shaped, reddish-brown coloration and weighs about 1.5 Kg. Liver is a versatile organ which performs multiple functions. It is an important organ for metabolism and elimination of drugs. Subsequently, it is not surprising that liver diseases are the major cause for morbidity and mortality. The gastrointestinal homeostasis and body function in general is maintained by the liver. Approximately,75% of blood supply in the liver is from the gastrointestinal organ and spleen through portal veins hence the drugs and xenobiotics are in concentrated forms. Thus, the liver injury occurs when the biotransformation of the parent compound results in highly reactive metabolites that combines cellular macromolecules like proteins, lipids, nucleic acids to cause cellular disintegrity and dysfunction [1,84]. Consequently, the liver is prone to many diseases which are referred to as hepatic disease. The liver diseases are characterized by viral infection (hepatitis), cancer or tumor, autoimmune disease, cirrhosis, fibrosis, necrosis, acute cholestasis, micro vesicular steatosis[2]

2. Liver Injury

There are numerous factors that contribute to liver injury [3].Drug induced liver injury is theprimesource for both acute and chronichepatotoxicity[4]. Approximately, 1000 drugs are known to cause liver diseases. However, the chances of liver injury depend on the chemical properties of drugs, genetic and environmental factors. The etiology of drug-induced liver injury is due to the toxic drugs or their metabolites which modifies immune response or directly alters the biochemistry of the cell leading to cell-death[5,6]

Tumor Necrosis Factor (TNF-α) and liver injury

TNF (Tumor Necrosis Factor) is an important mediator to patho- physiological conditions leading to hepatocellular damage that accelerates the Hepatic Stellate Cell (HSC) and facilitates the deposition of extracellular matrix, the hallmarks of liver fibrosis. TNF not only is an inducer of hepatocellular damage, but also as a pro-fibrogenic factor in the liver[7] TNF-α is a vital protein synthesized in our body as an immune reaction to infection. However excess production of TNF -α can lead to destruction of cartilage, bone and various tissues involved in metabolic pathways. Infliximab,also known by the trade name Remicade blocks the action of TNF-α, which in turn suppresses the immune system thereby reducing inflammation and the related symptoms [8,43] Hepatotoxic drugs mainly activateTNF (figure.1). The interaction between soluble (s- TNF) with TNFR1 and membrane (m-TNF) with TNFR2 results in activation of IKK and JNK pathways by the adapter molecules TRADD, TRAF2, and RIP. The excessive stimulation of the downstream signaling molecule JNK acceleratesinflammatory responses and apoptosis which then results in destruction of hepatocytes[9]. The reactive oxygen species (ROS) production is essentialfor activation of JNK that in turn is involved in oxidation and inactivation of variousMAP kinase phosphates (MKPs). Actually, JNK activation induces phosphorylation of E3 ligase itch, ubiquitination and deprivationof NFBdependent Caspase 8 inhibitor c-Flip.Furthermore, activation of Nf-B blocks the prolonged stimulation of JNK and prevents the cell death through antioxidant production (MnSOD) [10,11]

3. Hepatotoxic Drugs

3.1 Paracetamol (Acetaminophen)

Paracetamol (N-acetyl –p-aminophenol) also known as acetaminophen is widely used as analgesics and antipyretic agents. Initially, paracetamol did not cause methemoglobinemia, hence, therapeutic use of paracetamol reached greater heights. In 1950's, the drug was available globally as an antipyretic and analgesic drug and one of themost frequently used over the counter drugs in several countries. Contrastingly, overdose of paracetamol leads to fulminant hepatic failure. Paracetamol is

mainly hepatotoxic, with the characteristic symptoms centrilobular hepatic necrosis with nuclear pyknosis and eosinophilic cytoplasm that extends toenlarged hepatic lesions. The factors that contribute to hepatotoxicity in experimental animals are age, sex and variation of interspecies [12,81]. Furthermore, rationale of combining a highly addictive drug (opiate) with paracetamol resulted a dose-dependent hepatotoxicity [13,81] The hepatotoxicity caused is not by paracetamol itself but due to the formation of intermediate metabolites during the metabolism. Paracetamol is detoxified via glucuronidation and sulfation in the liver. The reactive metabolite which is electrophilic in nature is conjugated with hepatic glutathione (GSH) and eliminated mainly as mercapturic acid in urine[14] On over dosage of paracetamol, glucuronidation and sulfation routes become saturated and within 1-2 hours there is a massive depletion in the hepatic GSH level.Thus, covalent interaction between the metabolite, N-acetyl-P-benzoquinoneimine with theintracellular macromolecules induces hepatocellular damage and necrosis[15.16] Acetaminophen/paracetamol induced liver injury mainly in hepatocytes, which play a key role in metabolism.The cytochrome p450 enzyme system is responsible for the metabolism of paracetamol to form N-acetyl-p-benzoquinone imine (NAPQI).However, when hepatic GSH is depleted, excessive NAPQI binds to cellular proteins covalently, and brings about mitochondrial dysfunction, oxidative stress, and ATP depletion.The oxidative stress in turn leads to the nitration of mitochondrial proteins, the DNA damage of mitochondrial, ultimately resulting in the mitochondrial permeability transition and cell death [17.18]

3.2 Methotrexate

Methotrexate is a folic acid antagonist, extensively used in lymphoma,leukemia, and several solid organ tumors[19].Methotrexate is a powerful immunosuppressant usedin the treatment of autoimmune diseases.Methotrexate (aminopterin derivative) was developed in late 1940's. The rapidly multiplying cells are more susceptible to cytotoxic effects of methotrexate as methotrexate acts actively on the dividing cells in S- phase [20]. Previously, methotrexate was approved in chemotherapy of cancer in the United States(1955), psoriasis (1972) and rheumatoid arthritis (1988) andpreferred for all these conditions until today [21]. The folate antagonist acts by inhibiting the dihydrofolate reductase enzyme (DHFR), which results in limited or no conversion of folic acid to tetrahydro folic acid.Tetrahydrofolate maintains the intracellular pool for the purine nucleotide and is also involved in thymidylate synthesis. The action of methotrexate not only impairs the proliferating malignant cells but also impairs the normal proliferating cells in bone marrow cells, fetus, buccal and intestinal mucosa and urinary bladder[22]. The blockade of DHFR results in reduction of nucleic acid synthesis due to impaired thymidylate and purine biosynthesis,mainly DNA synthesis, repair and replication [23]. Methotrexate augments serum aminotransferase activity and prolonged therapy has been linked to fibrosis, fatty liver disease and cirrhosis[25]. The mechanism of liver injury is due to direct toxicity that involves blockade of nucleic acid synthesis(RNA and DNA) in the liver and arrests the cellular multiplication that end in the steatosis and hepatic fibrosis[26]

3.3 Carbon Tetrachloride

Carbon tetrachloride (CCl_4), obtained from reaction between chloroform and chlorineis household cleaner, degreaser and an industrial solvent. The use of CCl_4 gradually decreased due to its toxicities. Nowadays CCl4 are extensively used as a model drug to study the hepatotoxic effects.[27].CCl_4 is activated by the liver enzymes mainly by cytochrome to form a highly reactive radical, trichloromethylradical (CCl_3). CCl_3 radicals bring about impairment of cellular processesinlipid metabolism that leads to steotosis. CCl_3 on oxidation is converted into a more highly reactive free radical trichloromethylperoxy radical (CCl_3 OO). The free radical CCl3 OO initiates lipid peroxidation that induces disruption of phospholipid bilayer thereby affects the permeability of mitochondria, endoplasmic reticulum, loss of homeostasisresultant cell damage [28]. The activation of, nitric oxide,tumor necrosis factor and transforming growth factors alpha and beta in the cell by CCl4 and alteration of cellularprocesses causesself-destruction or fibrosis at the molecular level [29,30,31]

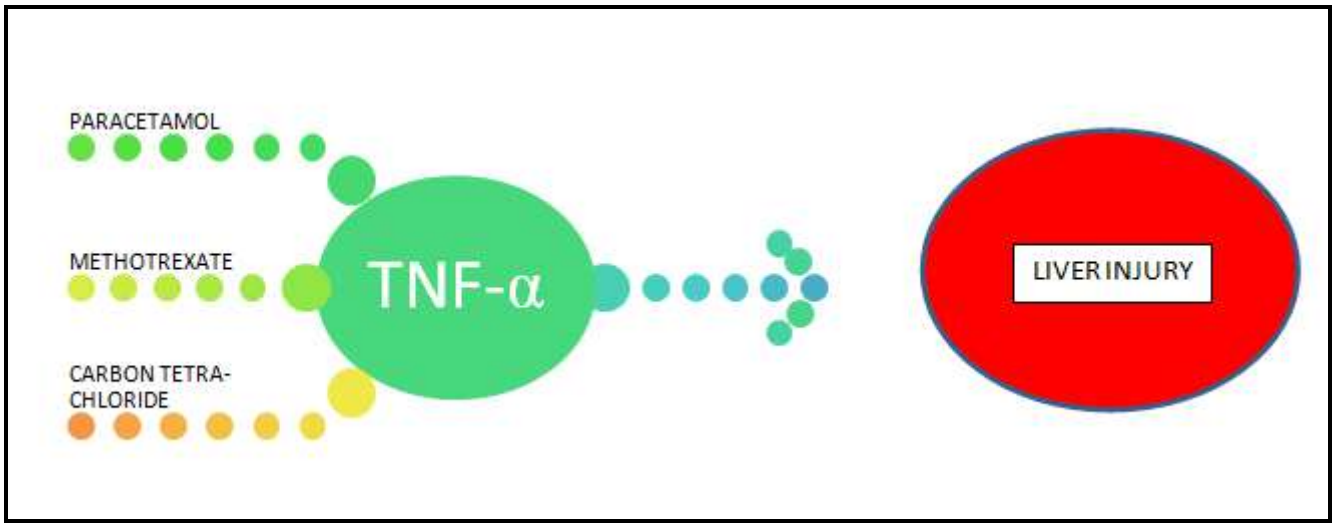

Figure 1. Hepatotoxic drugs and liver injury

4. Infliximab to counteract hepatotoxicity

Infliximab first approved drug (U.S. Food and Drug Administration (FDA)(1998))and European Medicine Agency (EMA)(1999), Pharmaceuticals and Medicals Devices isused as Reference medicine in pharmacotherapy of Behcet's disease, ankylosing spondylitis,inflammatory bowel disease,Crohn's disease, atopic dermatitis, Rhematoid arthritis and Psoriatic arthritis as orphan drugs. The monoclonal antibody of TNF alpha possesses potent anti-inflammatory effect and reduces the structural damage, induces remission and minimizes the usage of steroids, hospitalization and surgeries in serious inflammatory conditions [32-37] This monoclonal antibody was developed using recombinant DNA technology by combining the IgG of mouse and human. Hence it is called as chimeric monoclonal antibody. This drug is administered for treating a variety of autoimmune disease. Infliximab acts by preventing thebinding offree floating soluble and transmembrane forms of TNF-α with receptorsand neutralizes most of the biochemical actions of TNF-α[38,39] Some of the adverse effects are serious infection, reactivation of hepatitis B, acute hepatic injury, psoriasis, demyelinating central nervous system disorder, vitiligo, hepatosplenic T-cell lymphoma [40]. Hepatotoxicity is associated with elevation in serum aminotransferase, hepatocellular injury, cholestasis, reactivation of hepatitis B [41].

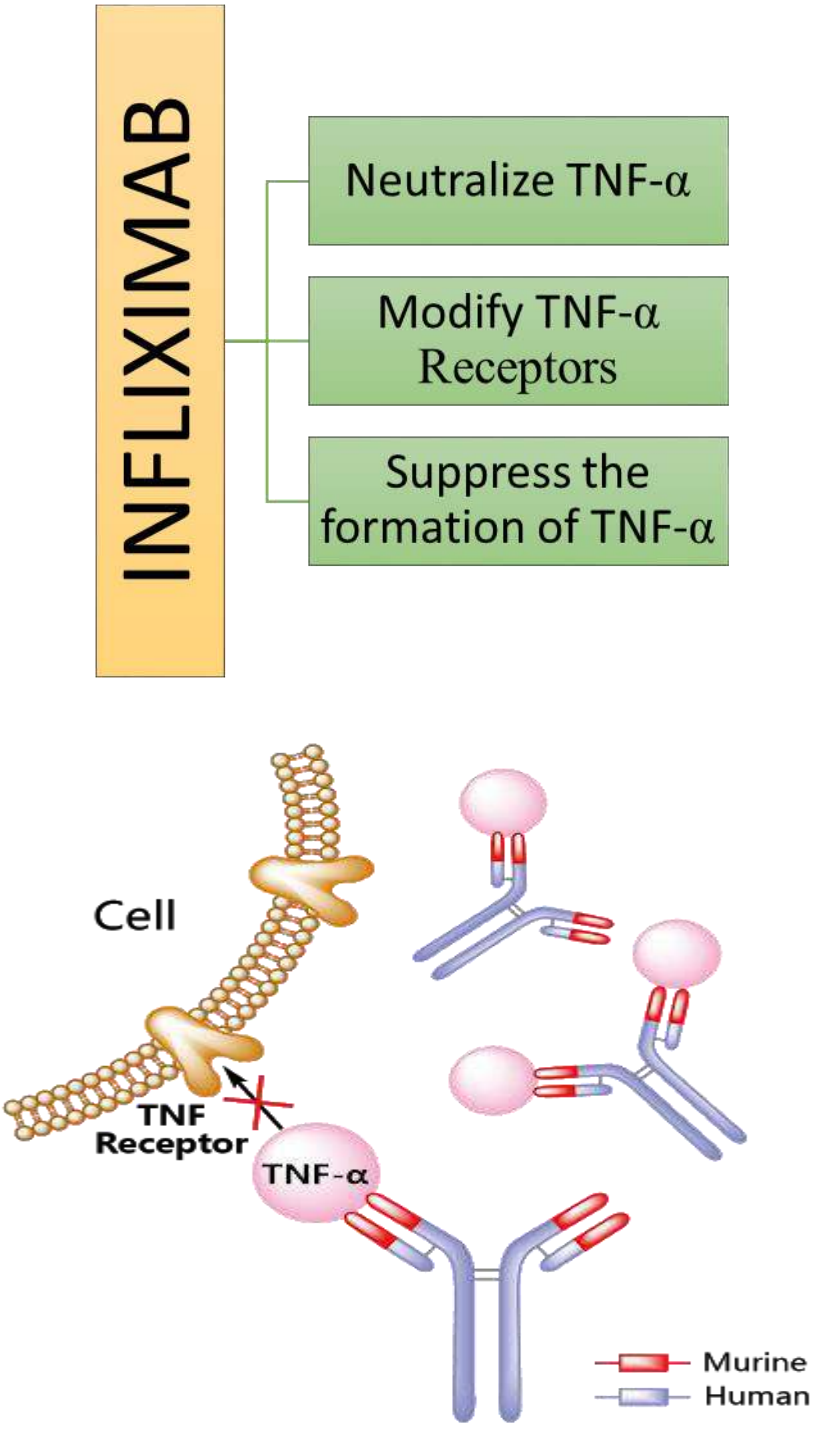

Figure 2. Infliximab and mechanism of TNF inhibition

4.1 Possible Mechanism of Protective Activity of Infliximab

Infliximab acts by blocking TNF-αbinding to its receptor and inhibiting transmembrane proteins. The TNF-α activates the cytokines induced inflammatory responses that includes release of interleukin-1 (IL-1) and IL-6,migration of leukocyte; eosinophil and neutrophil and stimulation of tissue degrading enzymes and acute phase reactants [42,43]. The functional activities of TNF-α can be neutralized with the treatment of infliximab which shows an overall reduction in the inflammation. Infliximab therapy results in the reduction of IL -1 and IL - 6 production, leukocyte migration and expression of adhesion molecules by leukocyte and endothelial cells. The drug also causes limitations of the biological activities of eosinophils and neutrophils and decreases the generation of degrading enzymes made by chondrocytes and synoviocytes. The anti-TNF-α-mediated mechanisms of liver damage include (A) blockade of TNF-α thatcausesimpairment or suppression of auto-reactive B cell synthesis and enhancement of lymphocyte due to apoptosis of CD8 T cells and triggers the autoantibodies development; (B) a dual antagonizing effect exerted by TNF-α on two TNF receptors ie(TNFR1 and TNFR2) expressed on T cells that can lead to inflammatory response.TNF-α Binds mainly to TNFR1and stimulates the effector T cell, initiating inflammatory response.WhereasTNF-α Binds to TNFR2, expressed on the regulatory T cells, result in the attenuation of inflammation and also prevent autoimmunity [45]. The response may be influenced by immunological and genetic variation in individual [46-48]
Infliximab, an anti-TNF-α agent, possibly shows the protective activity by binding to TNF-α and neutralizing them. Thus, the release of TNF-α as a result of hepatotoxicity by the intake of hepatotoxic drugs such as paracetamol, methotrexate, carbon tetra-chloride can be attenuated by the infliximab(figure.2) [49,50].
Activation of Tumor necrosis factor-α (TNF-α) a prototype of the TNF family secreted by macrophages is the main cause for hepatic injury and inflammation [51,52]. TNF-α attaches to its receptors (TNF-R1, TNF-R2) and stimulatesseries of intracellular cascades and activates NF-κB which in turn provokes cellular activation, differentiation, cytokine production and apoptosis [53]. Additionally, exert pro-apoptotic effects on T cells and block the production of Th1 type of cytokines. The TNF-α is blocked by infliximab, suppressing the proinflammatory cytokine release and regulation of the purine metabolism [54,55]. Toxicity of infliximab may be transient ischemia to serious anaphylactic reactions that includes upper respiratory tract infection (32%),misc. Antinuclear antibodies (~50%) Infection (36%), GI -Nausea (21%),complement activation, (20%; severe <5%),abdominal pain (12%; Crohn's 26%) and Infusion reactions which includes cytokine release syndrome(cytokine storm, IgG mediated Type -1 hypersensitive and anaphylacticdegranulation of mast cell'sreaction [56-59].

4.2 Evaluation of protective activity of Infliximab

4.2.1Paracetamol (Acetaminophen)

The increase in serum enzyme levels is the biomarker of liver injury. Generally, thevaluesof AST and ALT areused aspreclinical and clinical markers for the prediction of liver injury. These enzymes located in cytosol are released into the circulation when the liver cells are damaged. Hence, they are considered as essential markers to evaluate the extent of hepatocellular injury In a study, acetaminopheninduced hepatotoxicity in rats, the level of AST and ALT in the serum reached high levels indicating high level of hepatocellular damage. But the levels of serum enzymes became normal on administration of infliximab (Table 1). This shows the attenuation of liver cell injury by the infliximab and thus the cytosolic release of serum enzymes is controlled[60-63].

TABLE 1: Serum AST and ALT levels of Paracetamol and Infliximab (Irmak Ferah,et.al, 2013)

Serum level	Control	Infliximab	Paracetamol	Paracetamol+infliximab
ALT (U/L)	43.38 ± 10.18	40.13 ± 2.37	175.13 ± 63.63	50.05 ± 6.46
AST (U/L)	77.06 ±12.11	73.00 ± 10.51	221.38 ± 68.58	94.25 ± 26.12
TNF-α (pg/ml)	35.25 ± 10.38	30.50 ± 7.84	181.00 ± 40.96	47.50 ± 6.80

Paracetamol toxicity also enhances oxidative stress and lipid peroxidation which gradually leads to cell damage. Oxidative stress leads to accumulation of free radicals and peroxidation of lipids leads to malondialdehyde (MDA) production, the end product of lipid peroxidation. According to previous researchers, high dosage of paracetamol intake increased accumulation of MDA in the liver tissue. Subsequently, on treatment with infliximab, declineof MDA levels was observed in the liver tissue. Hence, the evidence suggests that treatment of paracetamol induced hepatotoxicity with infliximab shows beneficial effects[64-65].

4.2.2 Methotrexate

The earlier in-vivo study indicates thatoverdose of methotrexate administrationcauses rapid increase in serum AST and ALT levels due toliver cell damage. However, on treatment with infliximab the level of the serum enzymes were normalized (Table 2) [24].

TABLE 2: Serum AST and ALT levels of Methotrexate and Infliximab (Cure, et.al, 2015)

Serum level	Control	Infliximab	Methotrexate	Methotrexate+Infliximab
ALT (U/L)	35.1 ± 6.6	35.9 ± 5.8	46.2 ± 13.6	44.0 ± 13.8
AST (U/L)	34.0 ± 7.7	33.7 ± 4.2	66.4 ± 10.2	53.6 ± 16.8
TNF-α (pg/ml)	310.2 ± 54.9	285.1 ± 39.6	449.1 ± 95.1	360.9 ± 53.7

Methotrexate induced toxicity also showed an increased oxidative stress. As a result the proinflammatory cytokines are released into the circulation thus enhancing the liver cell damage. But on treatment with infliximab, TNF-α inhibitory agent,

shows excessive suppression of proinflammatory cytokines and protective against the liver injury[66-69] Additionally, Infliximab reduces the cellular defense mechanism against tumor cells due to alteration in arginine level, an essential mediator that influences immune responses [70,82]

4.2.3 Carbon Tetrachloride

CCl_4 is used as a reference drug for inducing liver toxicity in experimental models. Hence,the increase in hepatocellular damage is evaluated by clinical markers such as serum enzyme levels, lipid peroxidation, oxidative stress, fibrosis. In a study, administration of CCl_4 showed rise in the serum AST and ALT levels. TNF-α is involved in pathogenesis of liver fibrosis due to the activation of the Kupffer) and involved in cell differentiation, stimulation, immunomodulation, and proinflammatory activity.On further treatment with infliximab, TNF-α inhibitory agent, showed reduction in the serum enzyme levels. It may possibly be due to the suppression of TNF-α activity andthereby apoptosis by infliximab(Table 3)[71-73] Furthermore, infliximab reduces the fibrogenic and necro-inflammatory activity of CCl4and prevents hepatic fibrosis due to CCL4. In addition, infliximab causes blockadeof the IL-6 release from Kupffer cells that in turn may modify cytokine and enhances anti-fibrotic effect [74-76,83]

TABLE 3: Serum AST and ALT levels of CCl_4 and Infliximab (Table 3) (Sehitoglu, et.al, 2015)

Serum level	Control	CCl_4	CCl_4 + Infliximab
ALT (U/L)	60.1 ± 19.9	917.6 ± 142.9	540.8 ± 313.4
AST (U/L)	197.5 ± 21.0	1375.3 ± 282.6	962.2 ± 535.1
TNF-α (pg/ml)	74.9 ± 18.4	134.3 ± 35.3	111.6 ± 8.7

The oxidative stress induces the production of reactive oxygen species (ROS) and peroxynitrite. The accumulation of ROS exacerbates the liver injury and leads to dysfunction of the hepatic cells. On administration of infliximab, TNF-α inhibitory agent, the ROS levels reduces thereby prevents the cellular damage [[77-80,85]

5. CONCLUSION

The concentration of TNFα is vital for determining the fate of the cell. Previous studies suggest the elevated concentrations of TNF-α enhanced the processes of cell death in hepatocytes, but minimum concentrations of TNF-α facilitates the survival of the liver cells.The present study concludes that Infliximab can counteract the hepatotoxic effects produced by the hepatotoxic drugs that include paracetamol,methotrexate and CCl4, by minimizing ROS productionthrough the inhibition of TNF-α.

CONFLICT OF INTEREST

Conflict of interest declare none.

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SP-38

An Update On The Use Of Herbal Medicine And Dietary Therapy For COVID-19 Prevention

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Abstract: A novel coronavirus disease (COVID-19), which is spread from human to human, has quickly developed into the pandemic that is causing the current global health crisis. COVID-19 is caused by the extreme acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is thought to be zoonotic in nature. This review summarizes the research on the effects of herbs and foods on corona viruses in order to promote the use of dietary therapy and herbal medicine as COVID-19 preventive therapies. The number of current studies demonstrates unequivocally that foods and herbs have the potential to be antiviral against SARS-CoV-2 and also can help prevent COVID-19. Foods and herbs would be used as nutritional or alternative therapy to avoid infection and improve immunity, as antiviral agents for masks, as disinfectants to avoid aerosol transmission, or as surface sanitizing agents. These theories, however, must be tested experimentally in SARS-CoV-2 and COVID-19 patients.

Keywords: COVID-19, SARS-CoV-2, Siddha herbal medicines, Dietary therapy

INTRODUCTION

COVID-19, also known as SARS-CoV-2, a novel coronavirus disease, began causing a global epidemic of acute respiratory disease in December 2019. COVID-19's rapid spread was declared a pandemic by the World Health Organization on March 11, 2020[1]. Corona viruses were classified as members of the Coronaviridae family in 1960, where they were classified as "positive sense single-stranded ribonucleic acid (RNA) viruses." 1 Corona is derived from Latin and means "Crown" or "Halo," which is a rare "appearance under two-dimensional transmission electron microscopy" which may appear to be covered in club-shaped spike peplomers. 2. Within the Coronaviridae subfamily, corona viruses are transmissible to humans. Corona viruses are derived "from the bat species (Rousettus leschenaultii)." MERS-CoV, SARS-CoV, and SARS-CoV-2 are the other coronavirus strains. SARS-CoV-2 is responsible for COVID-19 which was distinguished "in Wuhan, China in December 2019" and announced a pandemic by the WHO in March 2020. COVID19 clinical presentations range from mild cold-like symptoms to life-threatening respiratory failure. COVID-19 is found in two forms, S and L, according to the researchers. COVID-19 S strains are less virulent and adoptable to the human receptor than L strains, and their gene mutations account for the difference in filling (i.e., L form is mutated). 11. It is caused by a rapidly spreading virus that replicates itself by inserting its genome into the genes of other organisms. As a result of its reliance on other species for growth, it makes eradicating the disease-causing agent more difficult and it" is becoming a hot topic of study among drug producers, researchers, and scientists [2]

Infection Mechanism

The COVID-19 virus spreads from human to human simply by close contact with an infected individual. Individuals who exhibit symptoms such as sneezing or coughing can transmit the virus via respiratory droplets or aerosols, which enter primarily through the lungs through inhalation. Additionally, individuals with a weakened immune system or other co morbidities such as diabetes, chronic kidney disease, or cancer are more susceptible to infection [3,4.] The SARS-CoV-2 pathogen primarily targets the human respiratory system through angiotensin-converting enzyme 2 (ACE2) and angiotensin receptors, both of which are highly susceptible to COVID-19. Although the data indicated that the most common cause of death was extreme atypical pneumonia, it was later discovered that other internal infections or co morbidities may facilitate the spread of this lethal virus [5,6]

Herbal medicine for COVID-19

Historically, herbal medicine played a significant role in the prevention of infectious diseases. Clinical evidence from a variety of studies on herbal medicine's efficacy in treating SARS coronavirus (SARS-CoV) infection has demonstrated substantial findings, confirming the notion that herbal medicine is useful in the treatment and prevention of infectious diseases [7]. According to a Cochrane systematic review, herbal medicine used in conjunction with conventional medicine can improve symptoms and quality of life in SARS-CoV patients[8].Herbal medication is considered one of the potential methods in the treatment of COVID-19 based on prior experience.

Siddha is a unique medical system that originated in Tamil Nadu and is based on the Tamil language. The term "Siddha" literally translates as "known reality." [9] Siddha medicines are said to relieve the disease's root cause by balancing vatham, pitham, and kapam. Numerous Siddha formulations are available, including kudineer, mattirai, chooranam, parpam, chendurum, karuppu, and mezhugu. The aim of this review is to examine the many herbal and herb mineral formulations that have been used to prevent or treat COVID-19.

Fundamental Ideas and infectious diseases in Siddha System

All substances in the universe, according to the Siddha system, are composed of five fundamental primal elements: earth, water, fire, air, and space; while the human body is considered to be an amalgamation of three humors and seven physical components. Changes in environmental variables such as climate, water, habitat, and season are attributed to disease emergence (24). These environmental, epidemiological, seasonal, and water-borne diseases can be related and handled using principles from Siddha Pathology [10]. Agasthyar Pallu describes Siddha drugs that are widely used to treat infectious and communicable diseases [11].The Siddha system of medicine is based on the principles and relationships of the body's humors: vali/vata (wind), azhal/pitta (bile), and aiya/kapha (phlegm), where the specific pathological condition could be identified by examining the nati (pulse) to ascertain the humor responsible. According to Siddha philosophy, pulsation and its movement take on various forms, such as that of a swan or peacock in cases of deranged vata humor; that of a hen or ant in cases of pitta imbalance; and that of a fly or vulture in cases of vitiated kapha [11]. A skilled Siddha physician is able to discern and recognize the humoral status of body parts on the right or left side via pulse movements[12], thus determining the type and cause of disease. Epidemics/pandemics are referred to in Siddha as 'Uzhi Noi' or 'Kothari Noi'. They are generally known as "Kollai Noikal" and most frequently occur during the "Ayana Santhi" months (end of the month of Uthara Ayanam & Thatchana Ayanam) that fall on Aadi (middle of July to August) and Margazhi (middle of December to January) in the Tamil Calendar. It is assumed that during those days, human immunity will be low; according to the Trithodam or Mukkutram theory (which is based on the three humors vata, pitta, and kapha), the incidence of diseases will increase due to the derangement of Mukkutram. Usually, Thottru Noigal (communicable diseases) is infected with Aiya kutram (respiratory-related illness) and becomes afflicted as a result of its Sthiram gunam (stability factor). According to Guru Naadi, Thottru Noigal is usually induced by Kirumi (Pathogens or Microbes). The symptoms are caused by Noiyinan vanmai (an individual's immunity); if it is well, the individual would be unaffected. As a result, Siddha formulations or practices are developed to neutralize Aiya kutram [13] and preserve the immunomodulatory function during this time span. According to the Siddha medicine system, COVID-19 is a Thotru Noi (communicable disease) caused by a breakdown in the body's immune system's battling an invading Kirumi (virus or pathogen), which directly results in Aiya noigal (respiratory-related illness) as a result of changes in food, behavior, and environment. Additionally, COVID-19 symptoms such as a moderate fever, sore throat, malaise, headache, shortness of breath, pneumonia, and respiratory failure are comparable to those of Kaphasuram. Additionally, as defined by Tirumantiram by Saint Tirumular, individuals with a weakened immune system or immunity are susceptible to epidemics [11]. In Siddha, all forms of pyrexia, including vector-borne diseases such as malaria and dengue fever, are grouped into 64 categories and collectively referred to as Suram. Within them, Siddha compares dengue to PittaSuram, as the symptoms such as haematuria, anorexia, vomiting, nausea, myalgia, dysentery, and fever with chills are similar to those mentioned in Sura Vadagam, which also explains the treatment. Dengue fever symptoms are also described in literature such as Siddha maruthuvam. Whereas Agastiyar sura nool 300 states that the 'Pitta suram' can result in bleeding similar to haemorrhages (kuruthi azhal) associated with dengue fever, and the symptoms mentioned above correlate to the WHO's description of dengue fever[14]. Similarly, Siddha compares COVID-19 to Kapha suram, as Kapha suram/Slethma suram symptoms include fever, cough, throat pain, anosmia, dysgeusia, shortness of breath, and exhaustion, all of which are associated with mild stage SARS-CoV-2. At the extreme stage, the symptoms correspond to the Sanni stage of Kapha or Kabavatha suram [15]. The Siddha research delves into various formulations for the management of Kapha suram, Kabavatha suram, and Sanni noi. As a result, it is clear that even without recognizing microbes and other harmful substances, Siddha herbalists and researchers would understand and apprehension the cause, source, and mode of infection, thereby controlling infectious epidemics. Thus, the above-mentioned hypotheses and findings support the efficacy of Siddha medicine as a major treatment for contemporary health problems.

Siddha's drug choice against COVID-19

From December 2019 to the present, the coronavirus that causes extreme acute respiratory syndrome has made a historic transition. COVID 19 has been a significant burden on the public health and economic stability of communities worldwide in the current era. The world is scrambling to find a cure for COVID-19, and health experts have indicated that boosting the body's immune system can help to mitigate the disease's effects and speed recovery. However, in Siddha, diseases are treated by the use of complex courses of medicine referred to as regimens. The protocol used to treat COVID 19 during the initial days of infection includes Kabusura Kudineer, Adathodai Manapagu, Thontha sura kudineer, Vajra kandi chenduram, Visha sura kudineer, and Nilavembu kudineer. The Siddha drugs chosen for COVID-19 control are based on their pharmacological action as described in peer-reviewed articles and book references that may aid healthcare workers and scientists in patient care. Table 1 summarizes the herbal formulations and their known pharmacological operation.

Table 1: A few Siddha medicines are used to treat COVID-19.

S. no	Siddha drugs	Pharmacological activity	Ref
1	Adathodai manapagu	Antipyretic activity, antiinflammatory activity, antioxidant activity, antiviral activity, and hepatoprotective activity	25
2	Kabasura kudineer	Antipyretic activity, expectorant, antispasmodic, anti-asthmatic activity, antiviral activity, immunomodulatory activity, hepatoprotective activity, and antioxidant activity	21
3	Thontha sura kudineer	Antiviral activity, antiinflammatory activity, anti-asthmatic activity, hepatoprotective activity, and immunomodulatory activity	24
4	Vajra kandi chenduram	Antipyretic activity, antiinflammatory activity, antioxidant activity, and immunomodulatory agent	26

5	Visha sura kudineer	Antiviral activity, antipyretic activity, anti-asthmatic activity, anti-inflammatory activity, antioxidant activity, hepatoprotective activity, and immunostimulant activity	26
6	Nilavembu kudineer	Anti-inflammatory activity, antipyretic activity, hepatoprotective activity, immunostimulant property, antiviral activity, antioxidant activity, neuroprotective activity, and immunomodulatory activity	. 27

Adathodai Manapagu

This preparation is made from the juice of *Adhatoda vasica* (AV) leaves. *Adhatoda vasica* is a member of the family Acanthaceae. The plants contain "quinazoline alkaloids (vasicine, 7-hydroxyvasicine, vasicinolone, 3-deoxyvasicine, vasicol, vasicoline, vasicolinone, triterpenes, and anisotine)," betaine, hormones, carbohydrate, and alkanes. Triterpenes (a-amirine) and flavonoids (apigenin, astragalin, kaempferol, quercetin, and vitexin) have already been discovered in the flowers 30. *Justicia adhatoda* crude extract inhibits hemagglutination (HA) of influenza viruses. The assay demonstrates antiviral activity in the noncytotoxic range in two distinct layouts of simultaneous and posttreatment. At a concentration of 10 mg/mL, a methanolic extract of AV demonstrated a 100% rebate "in HA in the simultaneous and posttreatment. Simultaneous assays of the aqueous extract of J. adhatoda at 10 and 5 mg/mL concentrations reveal a reduction in HA to 33% and 16.67%, respectively. These findings indicate that aqueous and methanolic extracts of *J. adhatoda* possess significant antivirus activity, are capable of inhibiting viral attachment and/or replication, and could be used to prevent viral infection. 11 In the Dock assay, the compound vasicine demonstrates exceptional antiviral activity[16]

Kabasura kudineer

The kabasura kudineer is a siddha formulation that translates as [kabam – cold; suram – fever; kudineer – concoction]. Kabasura kudineer is a coarse powder of drugs that is used to make decoctions. This spice, widely known as the Bile of the Earth or King of Bitters, is indigenous to India and Sri Lanka[17]. It contains fifteen herbal ingredients, including *Zingiber officinale, piper longum, Syzygium aromaticum, Tragia involucrata, Anacyclus pyrethrum, Adhatoda Vasica, Coleus amboinicus, Tinospora cordifolia, Clerodendron serratum, Andrographis paniculata, Suda Acura*, and *Cyperus rotundus*.[18] *Zingiber officinale* aids digestion and is useful in the treatment of asthma, *piper longum* can be used to manage digestive problems, asthma, and cough, and *Syzygium aromaticum* has the ability to destroy bacteria and promote liver health. *Tragia involucrata* has already been shown to be beneficial in the treatment of bronchitis and pain. *Anacyclus pyrethrum* is beneficial in the treatment of mouth ulcers, sore throats, and coughs. *Hygrophila auriculata* [19] is used to treat blood disorders. Additionally, *Terminalia chebula* is used to treat coughs, asthma, anoxia, and vomiting. *Adhatoda Vasica* is beneficial in the treatment of respiratory and bleeding conditions. *Coleus amboinicus* is a common remedy for throat infections, coughs and fevers, nasal congestion, and digestive problems [19] *Saussurea Lappa* is a plant that is used to treat headaches, paralysis, asthma, coughs, fevers, and inflammation. *Tinospora cordifolia* has been used to treat diabetes, hypercholesterolemia, irritable bowel syndrome, and other cancers. *Clerodendron serratum* is used to treat jaundice and a variety of liver diseases. Since ancient times it has been used by Indians because of its therapeutic potential to manage different ailments. Kabusura kudineer has antibacterial, anticariogenic, antihelminthic, antidiabetic, antioxidant, astringent, antiviral, cytotoxic, and anti-inflammatory properties [20]. The phytocompounds in the kabasura kudineer Siddha formulation work by attracting/binding several amino acids at distinct sites on viral proteins, a process that is consistent with the well-known antimalarial drug artemisinin [21].This demonstrated the synergistic role of phytocompounds not only towards viral proteins and even against viral replication by modulating the immune system. *Trichosanthes cucumerina, T. cordifolia, H. auriculata, A. pyrethrum, A. paniculata, AV, S. lappa, C. serratum, S. aromaticum, and Z. officinale* could all suppress viral pathogenicity at different levels ranging from prevention to cure. It was discovered that formulations with functional significance against corona viral protein had a more effective inhibition activity on viral replication[21].

Thontha Sura Kudineer

The therapeutic efficacy of Thontha sura kudineer chooranam, which contains ten herbal ingredients (*Z. officinale, AV, A. paniculata, T. cordifolia, Elettaria cardamomum, Solanum xanthocarpum, T. cucumerina, Tephrosia purpurea, Mollugo cerviana, and Vitis vinifera*), was determined using in silico [22]. The phytocompounds in thontha sura kudineer demonstrated promising activity against the viral spike glycoprotein, preventing spike proteins from binding to the host cell receptor[23].

Nilavembu Kudineer (NVK)

"Nilavembu kudineer is a polyherbal formulation that contains *A. paniculata* as the active ingredient. It is effective against all forms of fever associated with body pain. Additionally, Vetiveria zizanioides, Santalum album, *T. cucumerina, C. rotundus, Zingiber officinale, Piper nigrum, and M. cerviana* are included [24]. Historically, these plants have been used to treat pyretic, "inflammation, arthralgia, arthritis, gastric ulcer, jaundice, and general debility conditions." Nilavembu kudineer effectively controls fever by regulating temperature, inflammation, and body pain, and it also acts to boost immunity[25].Many of the components in this formulation contain bioactive molecules that have been shown to be extremely effective against dengue, chikungunya, herpes simplex virus (HSV), and influenza virus[26].

Vajra Kandi Chenduram

It is a mineral-herb preparation that is widely used in Siddha practitioners for the treatment of a variety of acute and chronic illnesses ranging from fever to chronic inflammatory disorders and immune-mediated diseases. Purified lingam, veeram, pooram, and rasa sindhuram are used in this formulation. This substance exhibits antipyretic, anti-inflammatory, and antioxidant properties. Through its antipyretic and antiinflammatory properties, vajra kandi chenduram may have the ability to prevent the release of COVID-19's inflammatory mediators and cytokine storm, which would be a main source of serious lung

complications. Thus, in the absence of any particular target treatment interventions, this formulation may be recommended as a secure and reliable complementary therapy. " A novel strategy for COVID-19-induced cytokine release syndrome (CRS) is to target main molecules within the inflammatory cytokine network, such as interleukin-6 (IL-6). In people with severe COVID-19 infections, interleukin-6 inhibitors can ameliorate serious bronchial tissue damage caused by cytokine release. Numerous cases of bronchial tissue damage caused by cytokine release have been identified in patients with severe COVID-19 infections. 26 Available literatures suggest the presence of a "cytokine storm" characterized by the release of IL-6, IL-1, IL-2, and IL-8, as well as 'tumor necrosis factor' (THF) and other inflammatory mediators"[27].

Visha Sura Kudineer

Vishasura kudineer (VSK) is a polyherbal formulation derived from the Siddha text "Kaaviya Sura Nool." *Azadirachta indica, Indigofera tinctoria, Zingiber officinale, Hemidesmus indicus, Aristolochia bracteata, V. zizanioides, Glycyrrhiza glabra, E. cardamomum, and Santalum album* have been among the components. Each portion exhibits antiviral activity against a diverse array of viruses. "Aqueous leaf extract of *A. indica* possesses antiviral activity against vaccinia virus, chikungunya measles virus, dengue virus type 2, and herpes simplex virus type 1; it also possesses immunostimulant and anticomplement activity[28].*Indigofera tinctoria* inhibits HIV-1 (III B) and HIV-2 replication. "In human respiratory tract cell lines, *Zingiber officinale* exhibits antiviral activity against the human respiratory syncytial virus". Antiviral activity of *Hemidesmus indicus* was investigated against the Ranikhet virus. "Glycyrrhizic acid, a portion of licorice root, has antiviral activity by inhibiting the growth and cytotoxicity of many DNA and RNA viruses, including vaccinia, HSV-1, Newcastle disease, and vesicular stomatitis viruses." Additionally, it exhibits antiviral activity against flaviviruses such as dengue, Japanese encephalitis, Yellow fever, tick-borne encephalitis in mammals, influenza, and hepatitis A, B, and C viruses [29]. Sandalwood oil, an essential oil derived from the tree *Santalum album L.,* exhibited antiviral activity against HSV-1 and HSV-2 [30].

Immunity by Foods

As per the Siddha medicine system, food is considered medicine, and its proper consumption will help the body maintain its immunity. Food is critical in this crisis because it helps to develop immunity against foreign invaders in the human body[31]. Numerous researches have shown that an individual's nutritional status often influences the proper body functions as well as their psychological health [32]. It is not unusual for specific nutrients or a mixture of nutrients to play an impact on the overall health of the immune system. By controlling the development of signaling molecules and gene expression, nutrients influence an individual's immunity. As a result, immune cell function improves significantly [33]. Therefore, it is critical to consume a sufficient amount of vitamins and minerals in order to strengthen the immune system and allow it to fight any disease, including COVID-19. Carbohydrates, protein, and fat, as well as minerals and multivitamins, all play critical roles in boosting and maintaining immunity. According to a study, one of the fat-soluble vitamins D decreases viral replication rates, which can result in lung injury and pneumonia, by decreasing pro-inflammatory cytokines. Vitamin D benefits not only the musculoskeletal system, but also the respiratory system in this manner [34]. Apart from that, vitamins A, E, B6, and B12, as well as iron and zinc, are critical for developing a healthy immune system [35]. Vitamin C, on the other hand, is a well-known antioxidant that is needed to counteract the damage caused by reactive oxygen species (ROS) and thus protect the body from oxidative stress. Vitamin C (also known as ascorbic acid) contributes significantly to the maintenance of a healthy immune system by positively regulating T lymphocytes and NK (Natural Killer) cells [36].It has been well established that every viral infection has a detrimental effect on the body's vitamin C levels, and the patient's vitamin C requirement is dependent on the nature of the disease. As a result, in order to preserve an individual's and communities physical and mental well-being in the face of the COVID-19 pandemic, this review article has provided critical overviews of the value of diet and nutrition. Figure 1 explains the important vitamins for immunity and the source of foods.

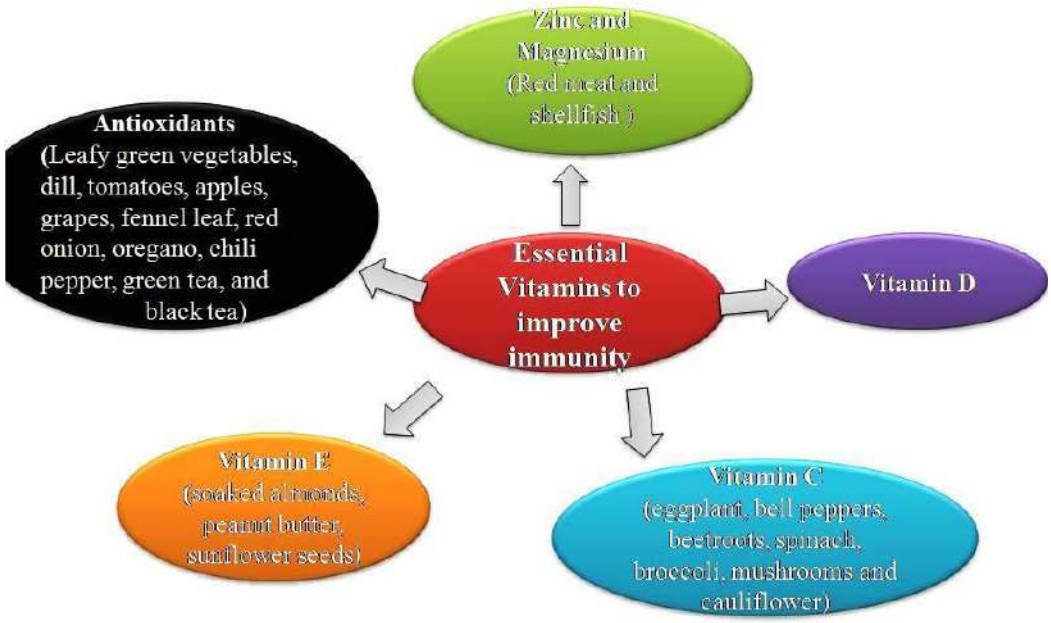

Figure 1: Therapeutic efficacy of essential oils vitamins to improve immunity

Zinc and Magnesium

Zinc is a micronutrient that is needed for DNA synthesis and cell proliferation (Fuhrman, 2020). Additionally, it plays a role in the regulation of innate and adaptive immune responses, cell signaling, and immune cell formation [37]. Zinc-containing foods include red meat and shellfish [38].Magnesium, a critical mineral for our immune system, is also a critical electrolyte that aids our bodies in strengthening their natural killer cells and lymphocytes. It is also a critical source of energy for our cells, adenosine triphosphate (ATP), which is so critical that our cells cannot survive properly without it. Magnesium aids hemoglobin in our blood, which would be responsible for carrying oxygen from our lungs to the rest of our bodies, which aids in a COVID19 infection, since the virus targets the respiratory tract [39]. Dark chocolate, black beans, avocados, and whole grains are all high in magnesium [40].

Vitamin D Rich Foods

The general metabolism and vitamin D activities are well-known[41]. Vitamin D3 is produced in the skin when UVB radiation interacts with 7dehydrocholesterol and causes a thermal reaction. Oral vitamin D or vitamin D3 is converted to 25(OH)D in the liver and then to the hormonal metabolite 1,25(OH)2D (calcitriol) in the kidneys or other organs as needed. Vitamin D exerts its entire effect through the entry of calcitriol into nuclear vitamin D receptors, a DNA-binding protein that frequently interacts directly with regulatory sequences surrounding particular genes and recruits active chromatin complexes that engage in transcriptional development modifications genetically and epigenetically. Calcitriol's most well-known function is to aid in the management of serum calcium concentrations, but it does so through a parathyroid hormone (PTH) feedback loop, which plays a variety of important roles in the organism. Numerous studies demonstrate how vitamin D minimizes the chances of viral diseases. Vitamin D works in a variety of ways to reduce the risk of viral infection and death. These components are classified into three groups in a report on the role of vitamin D in reducing the risk of catching a cold: adaptive immunity, physical barrier, and natural cellular immunity. Vitamin D promotes gap junctions, close junctions, and adherent junctions (e.g., via Ecadherine). Numerous studies examined how viruses compromise the junction's integrity, increasing virus infection and the growth of other microorganisms. Vitamin D enhances innate immunity in cells in part by converting 1,25dihydroxyvitamin D to antimicrobial peptides such as human cathelicidin, LL37, and defensines [42]. Cathelicidins exhibit potent antimicrobial activity against a wide range of pathogens, including Gram-negative and Gram-positive bacteria, enveloped and unencased viruses, and fungi. These host-derived compounds destroy foreign pathogens by rupturing their membranes, thus inhibiting the endotoxin's biological activity. As discussed previously, they perform a plethora of additional functions. LL37 inhibited influenza A virus replication in a mouse model. According to another laboratory study, 1,25(OH)2D inhibited rotavirus replication in vivo and in vitro using a different approach. Vitamin D supplementation at a dose of 4,000 IU/d was found to minimize dengue virus infection in a clinical trial. Vitamin D also enhances cellular resistance by intensifying the cytokine storm produced by the innate immune system. As shown in COVID19 patients, the innate immune system produces both non- and pro-inflammatory cytokines in response to bacterial and viral infectious diseases. Vitamin D has been shown to inhibit the development of proinflammatory Th1 cytokines such as tumor necrosis factor and interferon. Vitamin D administration reduces proinflammatory cytokine production and increases antiinflammatory cytokine production by macrophages and their references. Vitamin D is a potent immunomodulator; 1,25(OH)2D3 activates responses induced by T helper type 1 (Th1) cells, primarily by attempting to suppress the development of inflammatory cytokines IL2 and interferon gamma (INF). Additionally, 1,25(OH)2D3 promotes cytokine production by T helper type 2 (Th2) cells, which contributes to the improvement of indirect inhibition of Th1 cells by supplementing it with behavior influenced by a variety of cell types. Additionally, 1,25(OH)2D3 promotes T regulatory cell activation, thereby inhibiting inflammatory processes. Serum 25(OH)D concentrations begin to decline with age, which may be important for COVID19, as case fatality rates (CFRs) increase with age; possible causes include inadequate time spent in the sun and decreased vitamin D output due to decreased skin 7dehydrocholesterol levels. Additionally, some prescription drugs control serum 25(OH)D concentrations by activating the pregnane X receptor. These include anticancer, antiepileptic, antiinflammatory, and antibiotic drugs, as well as antiretroviral, antihypertensive, and endocrine medications. Pharmaceutical drug use usually rises with age. Vitamin D supplementation also increases the expression of antioxidation genes (glutathione reductase and the subunit controller glutamate–cysteine ligase). Increased glutathione development eliminates the need for ascorbic acid (vitamin C), which is also antimicrobial and has been recommended for COVID19 prevention and treatment [43].

Vitamin C and E Rich Foods

Vitamin C is critical for boosting immunity in children, adults, and even the elderly. Vitamin C-rich fruits such as bananas, papaya, kiwi, and guava should be included in the diet. Additionally, some vegetables such as eggplant, bell peppers, beetroots, spinach, and cauliflower are considered to be high in vitamin C and beneficial to the immune system. Green vegetables such as broccoli, mushrooms, and even kale are all good sources of immunity boosters. They significantly boost the immune system of older adults. Berries can also be used in the diet alongside omega-3 fatty acid-rich foods such as beans, flax seeds, and even some nuts. Spirulina and Curcumin are excellent sources of vitamin C and minerals for the elderly. These super foods contribute significantly to the development and strengthening of immunity. Water-soluble vitamins have important advantages in the treatment of sepsis and septic shock, a potentially fatal condition caused by pathogenic organisms' inflammation. Vitamin C also benefits the body by acting as a prooxidant for immune cells, an antioxidant for lung epithelial cells, and having immunosuppressive properties[44]. Oranges, kiwi, kale, and broccoli are all vitamin C-rich foods[45]. Vitamin E is important for aged people's general health, especially their immunity. Vitamin E is an incredibly strong antioxidant that could really help protect against a number of diseases, bacteria, and viruses. Consume soaked almonds, peanut butter, sunflower seeds, and

even hazelnuts to satisfy the daily vitamin E need. Vitamin E primarily serves as an all-purpose, chain-breaking antioxidant, mitigating the risk of lipid peroxidation. This vitamin is often a peroxyl radical scavenger, securing the polyunsaturated fats present in plasma membranes and lipoproteins[46] Quantification of F2 isoprostan is the most effective in vivo predictor of free radical formation and oxidative lipid destruction [47]. By supplementing with vitamin E, the F2 isoprostans are improved, and their emission could be reduced. Vitamin E plays a vital role in immune response maintenance, even with a slight deficiency impairing immunity, or supplementation at higher doses than suggested improving elderly people's humoral and cell-mediated immunity [48]. These results have attracted attention with whether or not vitamin E supplements could mitigate immunosuppression and oxidative stress during periods of extreme stress. Numerous studies have demonstrated that 1–5 months of vitamin E supplements (200–1200 IU dl –tocopherol) improves plasma tocopherol levels but also has a negligible impact on athletic efficiency, muscle damage indices induced by contraction, and has a significant impact on exercise-induced oxidative stress. The ambiguity of these findings is due to the investigation of design problems, such as the subjects' exercise timing and structure, their health or age ranges, the volume and shape of the vitamin E supplement, and the methods for measuring oxidative stress [44]. The effect of vitamin E supplementation on immune and inflammatory responses to prolonged exercise is unclear and ambiguous. Although the relationship between reactive oxygen species and immunity is not well known, substantial evidence indicates a correlation [49]. Although the generation of ROS and antioxidant status has been related to immune differences in certain disease processes and the recovery process, this relationship has not been studied in human athletic effort. In a previous study, vitamin C supplementation during an ultramarathon had no impact on the oxidative stress and immune disturbances caused by physical exercise [50]. Vitamin C primarily acts as an antioxidant in vivo by scavenging free radicals such as peroxyl and oxygen in the aqueous process. Even though vitamin E suppresses the spread of lipid peroxidation, we proposed that the aforementioned multivitamin has a potential to function as a protective measure against changes in immunity and lipid peroxidation caused by activity than vitamin C. The aim of this study was to determine the effect of vitamin E supplementation on oxidative stress and immune changes following the World Triathlon Championships in Kona, Hawaii. For two months prior to the race, thirty-eight randomized, double-blind triathletes obtained vitamin E (800 IU dl D — tocopherol) capsules in addition to placebo capsules. Vitamin E supplementation is concluded to relieve physical activity-induced increases in immune alterations associated with extreme discomfort, oxidative stress, and proinflammatory cytokines [51].

Antioxidants

Glutathione is a potent antioxidant with in body; it neutralizes harmful free radicals, aids in tissue repair, and synthesizes chemicals and proteins used by the immune system. NAC, or N-acetylcysteine, facilitates glutathione production and is often used as a supplement. NAC was found to minimize the severity and length of symptoms in animal models of other viral infections by increasing cellular defense and repair. NAC is taken in doses ranging from 500 to 600 mg. Glutathione can be taken orally in 500 mg doses or intravenously in 400–2400 mg doses under the supervision of a physician. Quercetin is a type of bioflavonoid that occurs naturally in a wide variety of fruits and vegetables. Quercetin has been shown in animal and laboratory studies to prevent a wide variety of virus infections, including the COVID19-related coronavirus SARS CoV. Quercetin contributes to the antioxidant potential of the body and protects lung tissue. Bromelain is marketed as a single supplement when combined with vitamin C between 500 and 1000 mg daily is recommended. Leafy green vegetables, dill, tomatoes, apples, grapes, fennel leaf, red onion, oregano, chili pepper, green tea, and black tea are all significant sources

Management

Isolation is the most effective method of containing COVID-19. COVID-19 is treated in conjunction with symptomatic care and oxygen therapy. Patients with moderate infections do not receive prompt supportive care". However, in Siddha, this infection is adequately "treated through the application of a specific course of treatment referred to as a regimen." The regimen used during the initial days of infection" consists of one or more formulations, including adathodai manapagu, kabasura kudineer, thontha sura kudineer, vajra kandi chenduram, VSK, and NVK. Out of six formulations, the dynamic active biomolecules in the aforementioned formulations exert a strong antiviral impact. Since AV is available in four formulations, the treatment regimen should include adathodai manapagu. However, the effectiveness of corticosteroids, a widely used anti-inflammatory agent, in treating CRS caused by COVID-19 is debatable. There is an immediate need for innovative therapies to treat CRS caused by COVID-19. The British Pharmacological Society has responded to concerns that non-steroidal anti-inflammatory drugs (NSAIDs) can worsen symptoms associated with the novel coronavirus COVID-19. The World Health Organization said on March 18, 2020, that it is "aware of concerns about the use of ibuprofen to treat fever in people with COVID19". 34 Thus, at this point in time, the use of Siddha anti-inflammatory, antipyretic, and immune-modulatory agents can be of tremendous assistance in managing CRS. Vajra kandi chendooram exhibits all of these properties; hence, it can be used in place of corticosteroids. As a result, Siddha drugs will help in the prevention of stage-I corona viruses progressing to the next stage, thereby reducing morbidity and mortality in COVID-19 patients. As a result, these medications are safe to administer in prescribed doses under the supervision of a Siddha physician. Additionally, these products have been toxicologically evaluated and found to be healthy for humans. As a result, the Siddha formulation described above may be considered to be of public use during this global pandemic.

CONCLUSION

"COVID-19 is rapidly spreading across the globe. In comparison to SARS or MERS, it has resulted in a greater number of infections and deaths. Due to the infection's rapid spread, exceptional surveillance and disengagement protocols are needed to prevent further transmission. Current treatment techniques" are mostly concerned with indicative oxygen treatment. Through this study, all of the ingredients in the Siddha formulations have been scientifically evaluated for their pharmacological effects, toxicity, and safety in humans. Further preclinical studies on the Siddha formulation's antiviral activity may be essential to scientifically confirm our hypothesis, and are currently being planned. Along with siddha medicines, dietary habit also very

important to increase the immunity of individuals. Individuals with a weakened immune system are more susceptible to this global pandemic dubbed COVID19. To aid or improve immunity, plant-based foods are critical because they promote the growth of beneficial bacteria in the body. Numerous vitamins, such as C, D, and E, are being studied for their potential to improve immunity. Vitamin C-rich fruits such as oranges, papaya, kiwi, and guava are available, while vegetables such as eggplant, bell peppers, beetroots, spinach, and cauliflower are also high in vitamin C and beneficial for immunity. A critical micronutrient is required for DNA synthesis and cell proliferation, both of which are required for the regulation of innate and adaptive immune responses. Vitamin D enhances cellular resistance in part by amplifying the cytokine storm produced by the innate immune system. Green vegetables such as broccoli, mushrooms, and even kale are a few immunity boosters that may significantly strengthen the immune system of older adults. Additionally, some herb combinations are considered to be critical in the prevention of COVID19. Future aspects of this account include the need for additional research on physical activities or exercises and their role in immunity-related issues, thus preventing COVID19. Additional research is necessary to understand the coronavirus's actions and the role of food in its prevention. Immune boosting food combinations should be investigated that include one and one makes eleven functions when combined. In a nutshell, green foods are critical in the fight against novel corona viruses because they boost immunity across all age groups.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-39

Prevalence of Self Medication and Associated Factors Among Urban Population of Thiruvallur District In South India

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Abstract: Self-medication practices could be beneficial to the public, provided these drugs are used rationally. Easy availability of over the counter drugs without proper prescription from the registered medical practitioners (RMP) in our country is primarily responsible for self-medication practices that ultimately lead to antimicrobial resistance, increased morbidity and mortality. Besides this there is also the problem of tachyphylaxis, drug abuse and drug dependency. Combating side effects and drug interactions in extremes of ages, risk of worsening of existing diseases poses a big challenge. The main objective of this study was to assess the prevalence and determinants of the self-medication practice (SMP) among the urban population. The cross sectional study was carried out in an urban field practice area of a tertiary care hospital. The total sample size was calculated to be 153. The participants were chosen by simple random sampling method. After obtaining informed consent the data was collected using a validated questionnaire. Among 153 participants, prevalence of self-medication was found to be 65.3%. The upper middle socioeconomic status (69.3%) have preferred self-medication out of which 21.2% reported pharmacist as the source of knowledge and 10.6% relied on information from internet. The most common symptom for which self-medication practiced was headache (79%) followed by cough and cold (69%). Most of the participants (77.8%) were aware of the fact that an antibiotic course must be completed even after cessation of symptoms, however 43.6% of the study subjects discontinued the antibiotic course once their symptoms disappeared. Self-medication is an important cause of drug abuse and overuse among Indian population. Health education of the public and regulation of pharmacies may help in limiting the self-medication practices.

Keywords: Antibiotic Resistance, Self-Medication

INTRODUCTION

Self-medication is regarded as a significant health concerns worldwide, the prevalence of which is on the increasing trend, more so in the developing countries. Major health bodies including World health organization have emphasized in identifying and controlling the practice of self-medication due to its public and professional concerns. It is generally considered a preferred choice for initial symptoms and is a part of patient's medical behavior. Self-medication is defined as "use of pharmaceutical or medicinal products by the consumer to treat self-recognized disorders or symptoms, the intermittent or continued use of a medication previously prescribed by a physician for chronic or recurring disease or symptom, or the use of medication recommended by lay sources or health workers not entitled to prescribe medicine".[1] The practice of self-medication is a double-edged sword with pros and cons. The auxiliary risks of self-medication practice include hinder in diagnosis of the condition, drug abuse, pharmacological resistance, mainly antibiotics, paradoxical economic loss and decimation of resources. In the face of these pitfalls of self-medication, it has its advantages such as management of minor illness thereby reducing the burden of health delivery systems. In India self-medication drugs are licensed as over the counter (OTC) drugs by the OTC committee of the organization of pharmaceutical producers of India. As the primary responsibility falls on the individual, it is of importance they are able to determine the conditions suitable for self-medication, its symptoms and appropriate medications which can be achieved by creating awareness among the general public. The prevalence of practice of self-medication in India where universal access to health care is yet to be achieved shows wide variation from 17% to 37% as compared to world 12.7% to 95%. The practice of self-medication is more so prevalent in the elderly, hard to reach areas such as hilly and tribal regions thereby leading to patients largely receiving substandard treatment.[2] In India, there is paucity of studies showing the enormity of self-medication practices. As the data from such studies could provide an insight into policy forming, identify factor which promotes OTC practice and help in overcoming this health concern. So, the present study was designed to estimate the prevalence of self-medication for allopathic drugs and associated factors playing roles in the practice of self-medication in an urban population of Thiruvallur district.

METHODOLOGY

Study design

Cross Sectional study

Study area and population

The study was conducted in urban health and training center of the department of community medicine, Sri Muthukumaran Medical College and Hospital. The study population included individuals residing in the field practice area and aged above 18 years. The time taken for the completion of the study was one month.

Inclusion and exclusion criteria

Patients above the age of 18 years including both sexes and those who gave informed consent were included in the study. Participants who were hesitant for study and who did not complete the questionnaire were excluded from the study.

Sample size and sampling technique

Sample size was calculated based on the prevalence of previous study. Using the Dabson's formula $4PQ/d^2$, with the allowable error of 5%, the sample size was calculated to be 153. Simple random sampling technique was used to identify the study participants.

Data collection

The objectives of the study were first explained to the participants and confidentiality of the respondent's demographic information and their responses were assured. Written informed consent for participation in the study was obtained. Finally, the questionnaires were given to them. The first part of questionnaire consists of socio-demographic details (age, gender, education, occupation, and income), practice of self-medication, and reasons for use of self-medication. The second part of the questionnaire includes the use of self-prescribed medications, reasons for it and methods of supply and duration of use of self-prescribed medications.

STATISTICAL ANALYSIS

Data collected was entered in Microsoft excel and analysis was done in SPSS software version 21.0. Data was analyzed using Descriptive and Analytical statistics. Chi-square test was used to compare the difference in proportions with the significant level of $p \leq 0.05$. Odds ratio (OR) with 95% confidence intervals was calculated to see the association between the exposure various variables in the foot.

Ethical approval and informed consent

The research protocol, informed consent and draft questionnaire were presented before the Ethical committee of Sri Muthukumaran Medical College and Hospital, Chennai and Permission was obtained.

RESULTS

There were totally 153 members from 153 households. Out of 153 people, 98 preferred allopathic self-medication in 3 months recall period. Sex, occupation, and age factors were found to be associated with self-medication. Participants used self-medications mainly for fever, headache, followed by spasmodic abdominal symptoms. The most frequently self-prescribed medications were analgesics, anti-histamines, vitamin supplements and antipyretics. Even antibiotics have been taken by the respondents without doctors' advice from pharmacy. The following tables and charts would show the exact data collected from the respondents and analyzed. As the table.1 clearly shows that a huge amount of self-medication is practiced by the younger age group of 18 to 25 years.

TABLE 1: Age Group of the Participants

AGE GROUP [IN YEARS]	Frequency(n)	Percentage
18-25	66	43.1
26-30	37	24.2
31-40	14	9.2
41-50	26	17.0
>60	10	6.5
Total	153	100.0

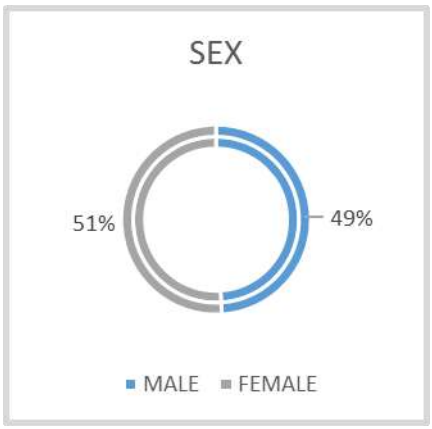

Fig. 1: Prevalence of Self-medication Practices based on Sex

This chart shows that 51% Female and 49% Male prefer self-medication. According to this study both the sexes almost equally prefer self-medication rather than visiting a doctor. As the table clearly depicts that around 86% of the respondents belong to student population. This is a very serious situation as this population is at risk of getting addicted to pain medication, develop drug dependency.

TABLE 2: Prevalence of Self-medication Practices based on occupation

OCCUPATION		Frequency(n)	Percentage
1.	STUDENT	86	56.2
2.	DOCTOR	2	1.3
3.	BUSINESS	13	8.5
4.	ENGINEER	29	19.0
5.	OTHERS	23	15.0
Total		153	100.0

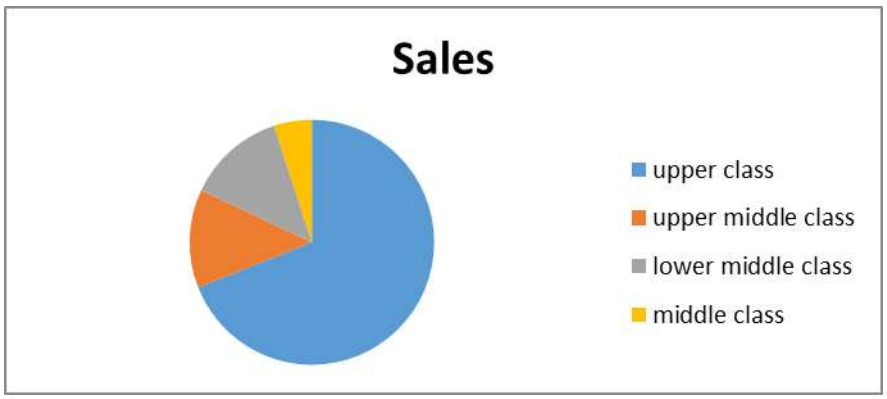

Fig. 2: The chart shows the socio-economic state of the respondents

Monthly income of the family was obtained from the study participants and the per capita income of the participants was calculated, after taking into account the total members in the family. Modified BG Prasad's classification was used to find out the socio-economic class of the participants. Majority of the study participants belongs to upper class(69%). Among the study participants 38% of them preferred old prescription as the mode of self-medication followed by pharmacist advice (18%).

TABLE 3: Source of knowledge and Practice about of Self-medication

If NO HOW DID YOU PREFER TO TREAT THE ILLNESS		Frequency(n)	Percentage
1.	OLD PRESCRIPTION	38	44.7
2.	PHARMACIST ADVICE	18	21.2
3.	INTERNET	9	10.6
4.	OTHERS	20	23.5
Total		85	100.0

TABLE 4: This table shows that around 50% of the respondents preferred -medication practices to save time.

WHY DID YOU PREFER SELF MEDICATION?		Frequency(n)	Percentage
1.	CLINIC AWAY	39	25.5
2.	SAVE TIME	38	24.8
3.	OLD PRESCRIPTION	6	3.9
4.	COST EFFECTIVE	13	8.5
5.	OTHERS	13	8.5
Total		109	71.2

The pie chart depicts that around 71% of the participants preferred Allopathic form of self-medication, 15% preferred Ayurvedic medicines, and 9% preferred Homeopathy.

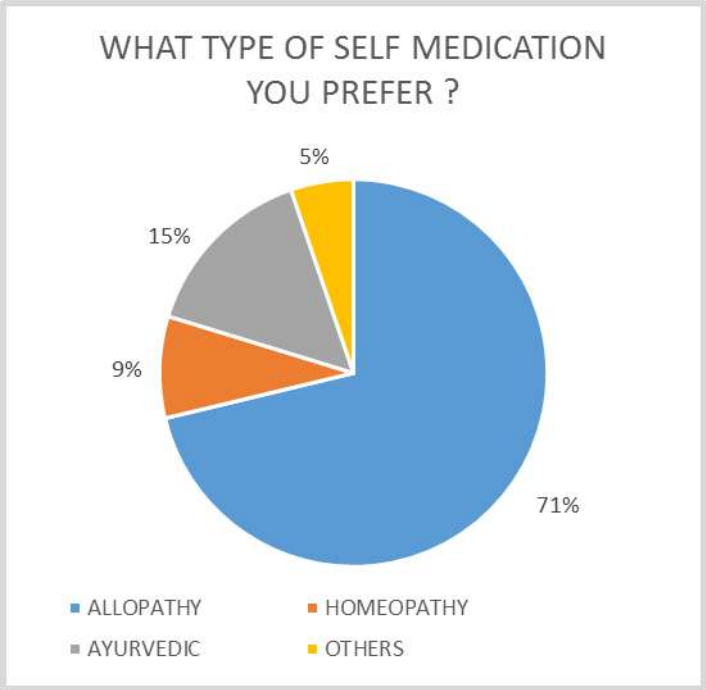

Fig. 3: Preference of self-medication

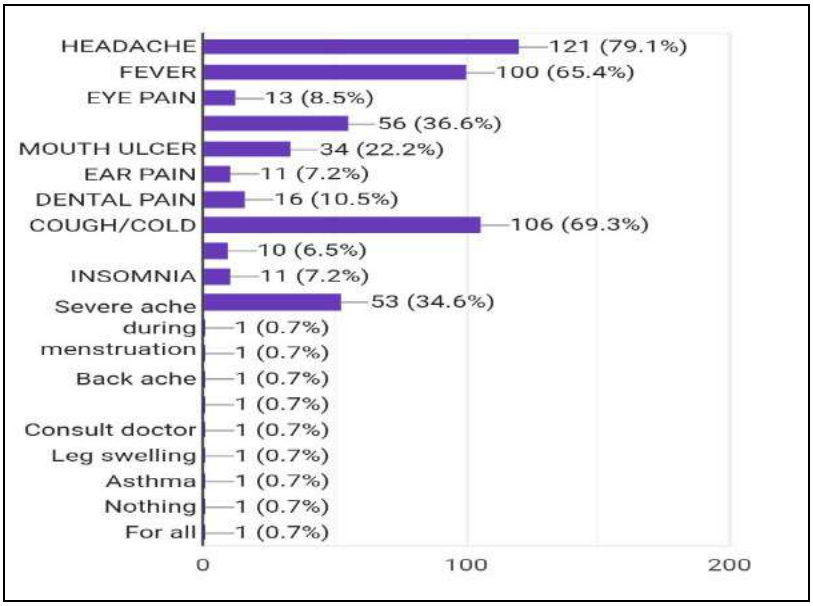

Fig. 4: The bar chart depicts the symptoms for which most of the participants preferred self-medication.

TABLE 5: Intake of multivitamins and supplement

HAVE YOU EVER TAKEN MULTI VITAMINS AND SUPPLEMENTS?	Frequency(n)	Percentage
YES	96	62.7
NO	57	37.3
Total	153	100.0

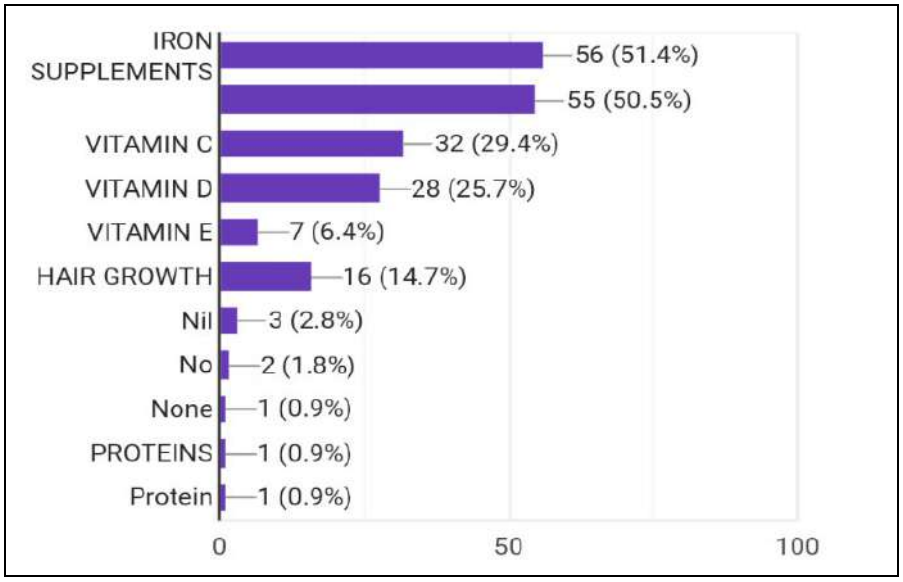

Fig. 5: The bar chart shows us the common multivitamins consumed by the respondents of the study.

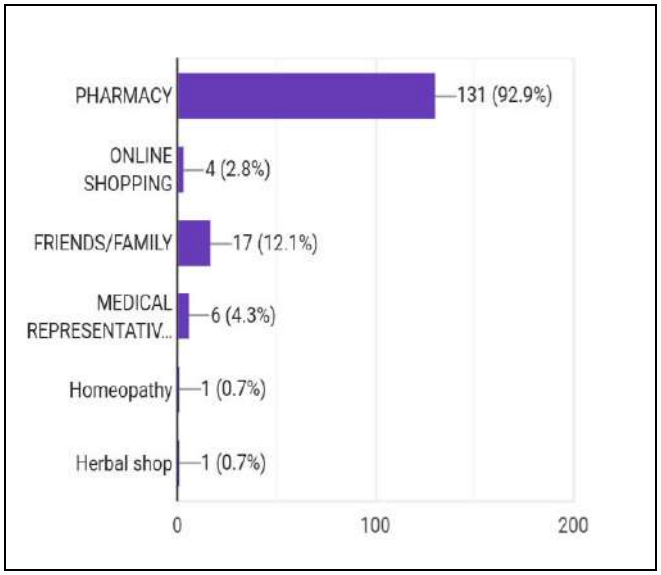

Fig.6: The bar chart depicts us that around 92% of the respondents consumed both medicines and multi-vitamin supplements from pharmacy without doctor advice.

TABLE 6: Prevalence of antibiotics usage by self-medication

HAVE YOU EVER SELF MEDICATED WITH ANTIBIOTICS?	Frequency(n)	Percentage
1. YES	70	45.8
2. NO	83	54.2
Total	153	100.0

The study shows that around 70% of respondents self-medicate with antibiotics without a doctor prescription.

TABLE 7: Knowledge about the dose of antibiotics

HOW DID YOU KNOW THE DOSAGE OF ANTIBIOTICS?	Frequency(n)	Percentage
1. CHECKING PRESCRIBING INSTRUCTIONS	24	15.7
2. INTERNET	16	10.5
3. PHARMACIST	4	2.6
4. PREVIOUS EXPERIENCE	34	22.2
5. NONE	30	19.6
Total	108	70.6

TABLE 8: Change of dosage of drugs			
WHY DID YOU CHANGE THE DOSAGE?		Frequency(n)	Percentage
1.	FORMER DOSE WAS INEFFECTIVE	18	11.8
2.	FORMER DOSE GOT OVER	11	7.2
3.	PHARMACY RAN OUT OF FORMER DRUG	2	1.3
4.	REDUCE SIDE EFFECTS	27	17.6
Total		58	37.9

TABLE 9: Stoppage of the course of self-medication			
WHEN DID YOU STOP THE COURSE?		Frequency(n)	Percentage
1.	AFTER SYMPTOMS DISSAPPEARED	44	28.8
2.	AFTER COMPLETE COURE	56	36.6
Total		100	65.4

TABLE 10: Knowledge about the completion of full course of antibiotics Around 77% of respondents do know the fact that a course of antibiotics should be completed once started.			
DO YOU KNOW THAT YOU HAVE TO COMPLETE A FULL COURSE OF ANTIBIOTICS?		Frequency(n)	Percentage
1.	YES	119	77.8
2.	NO	34	22.2
Total		153	100.0

DISCUSSION

In our survey, 65.3% respondents used medication without doctor's advice which is similar to a study done by Gaurav M Rangari et al.at Andhra Pradesh(68.1%)[3] and 44.7% used previous prescription to treat their illness over past 3 months. Over 56.9% of the respondents of our study preferred self-medication so as to save time from travelling to the clinic and also save money.70% of the respondents used paracetamol which is similar to a study conducted by Manish Jain et al. in an urban area of southern Rajasthan(73%)[4]. 90% of the respondents of our study obtained drugs from pharmacy with majority of them in student group aged 18-25 years which is very much higher than any studies. This is a rising concern as the not all pharmacies employ actual pharmacist and the amateurs and clerks working there hand over medicines we ask for. With such a high student consuming population certain regulations should be made to avoid this student population from getting drug dependent, drug tolerant, drug abuse and many other risk factors. Another interesting fact from our study is that around 9% of our respondents have experienced adverse effects from self-medication and then chose to consult a doctor. Apart from self-medicating for recurrent infections and allergies there is a huge population that self-medicates multi vitamins too. 62.5% of our respondents self-medicate multi vitamins out of which at least 25% of them have accepted to start by seeing advertisements and from medical representatives advice. Increasing trend towards the use of homeopathic and ayurvedic drugs for chronic illnesses like bronchial asthma, joint pains, obesity, acid peptic disease, impotence and female infertility by our respondents. Majority of our respondents believed homeopathic drugs were safe and devoid of adverse effects. In our study the participants preferred self-medication for pain followed by respiratory diseases and allergy. Analgesics were the most common class of the drug which participants used for self-medication followed by antibiotics and anti-allergic. Among the analgesics the most common drug used was paracetamol which is similar to the study conducted in South India.[5] Previous researches have indicated that self-medication with drugs can predicate higher risk of new-onset drug and alcohol abuse among those with baseline mood disorders [6] and that people that self-medicate can get addicted due to self-medication [7]. Previous studies among students showed that self-medication with stimulants, sedatives and sleeping medications was connected with self-perceived academic load and stress [8]. The fact that respondents in our study had most frequently bought their medication in pharmacies, as had the students in most previous studies [9,10] suggests that legal obligations might not be obeyed and issuing of these drugs is not controlled. Surveys conducted in other countries also showed that most frequently students choose what medicine they would self-medicate based on their own knowledge and experience which is similar to our study. In our study, participants prefer to self-medicate because the symptoms of their disease were not serious. This was also confirmed in other studies. However, long waits at the doctor's office was also a reasons why most of them preferred self-medication. A greater proportion of urban respondents and respondents aged below the age of 40 years took self-medication during the preceding six-month period. The better socioeconomic status of the respondents, their better earning power, and the higher educational level are probably among the reasons. However, this is difficult to reconcile with the fact that economic reasons were commonly cited for self-medication. Because of better educational qualifications the prevalence of self-medication among the younger generation was higher. Similar study done in Nigeria[11] showed that decreasing pattern of self-medication with increase in age. It is known by the fact that as a person gets older, he or she starts visiting doctor more frequently.[12]

CONCLUSION

Self-medication when practiced rationally could be beneficial to patients and healthcare delivery systems. In our study conducted among the urban population of the prevalence of self-medication practice was 63.5%, the major factor contributing to it being time management. The most commonly used drugs were analgesics for chronic pain, in comparison with other studies wherein antibiotics predominated in them. This caused a shift in focus from antibiotic stewardship to steps in reducing

analgesic overuse. In this study it is highlighted that self-medication practice is widely prevalent among graduates. Health education among the public and government regulation are the cornerstone in limiting self-medication practice.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-40

Zika Virus : An Update – A Brief Review

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Abstract: Zika virus is a mosquito-borne disease caused by the Flavivirus genus and the Flaviviridae family of arthropod-borne viruses (arbovirus). The Zika virus is predominantly transmitted by Aedes aegypti, but the virus can also be transmitted by other Aedes species. In Africa, ZIKV was first isolated from rhesus monkeys in 1947 and from mosquitoes in 1948. For half a century before appearing in the Pacific and the Americas, ZIKV infections in humans were intermittent. ZIKV is normally spread via the bite of mosquitoes that are infected. The clinical presentation of Zika fever, especially those due to arboviruses such as dengue and chikungunya, is unspecific and may be misdiagnosed as other infectious diseases. Before the major French diagnosis, The virus gained the attention of public health authorities because of its strongly suspected relationship with maternal-fetal transmission and microcephalus in infected animals. ZIKV infection was only associated with mild disease. Serological diagnosis is complicated by cross-reactivity among members of the genus Flavivirus. Moreover, this article will give a brief review on zika virus epidemic in India.

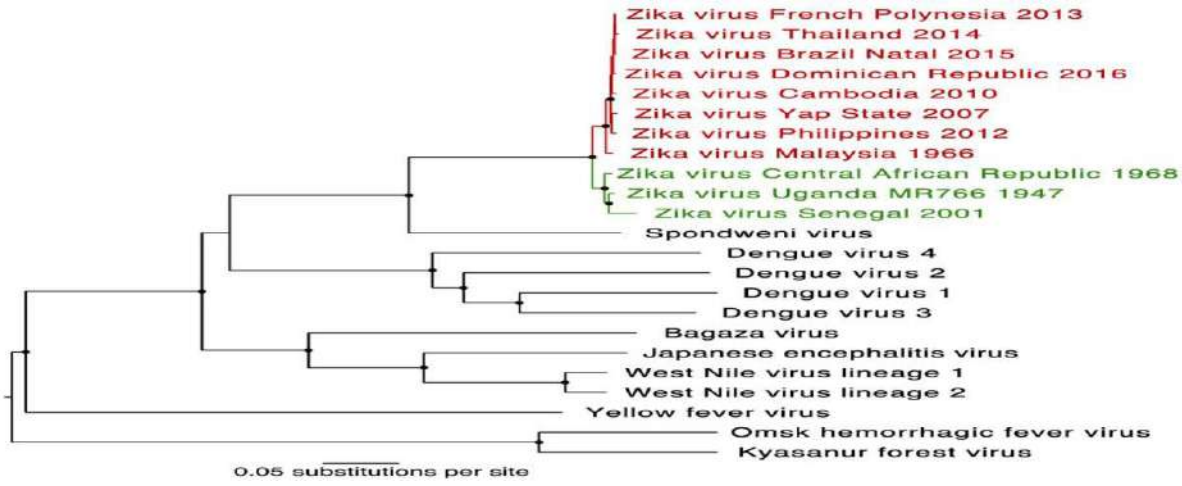
Key words: Zika virus, Mosquito borne disease, flavivirus

INTRODUCTION

The ZIKA (ZIKA) virus is now a global epidemic. Evidence of ZIKA transmission has been recorded in more than 72 countries and territories since 2007. The transfer of ZIKA has prompted the World Health Organization to recognise the situation as a health emergency. This situation is critical because the link between infection during pregnancy and the incidence of microcephaly and Guillain-Barré syndrome appears to be highly tangible.[1] The Zika virus is an icosahedral, enveloped, single-stranded RNA virus. A virus spread mainly by Aedes mosquitoes causes the Zika virus disease.[2] In February 2016, the WHO declared the Zika virus and its related complications a public health emergency of the International Concen. In the United States, Zika virus infection is among the globally notifiable diseases. An unexplained sharp rise in the occurrence of babies born with microcephaly and a summary of a new disease, congenital Zika syndrome, followed the first outbreak of infection with the Zika virus in Brazil.[1]

History of zika virus

In 1947, the Zika virus was originally discovered in a sentinel rhesus monkey in Uganda's Zika Forest. The virus is a member of the Flaviviridae family, the Flavivirus genus, and is spread to humans by mosquitoes of the Aedes group.[3] In 1948 it was isolated from Aedes africanus mosquito, in 1952 the first human cases are detected in Uganda by demonstrating neutralizing antibodies to zika virus in sera. Geographical distribution of Zika virus expands to Asia, including India, Malaysia and Pakista from 1969-1983 but in Africa sporadic human cases were detected with mild symptoms without any outbreaks.[4-6] In 2007, when the virus was associated with a minor outbreak in the Yap Province, part of the Federated States of Micronesia, the first evidence of the Zika virus was outside of Africa and Asia. Since then, infections of the Zika virus have been recorded worldwide, including in Southeast Asia, French Polynesia and the Pacific Islands, and parts of South, Central, and North America. Symptomatic human infection typically results in mild and self-limiting febrile disease, although recent studies have indicated a potential link with more extreme sequelae such as Guillain-Barré syndrome and microcephaly during pregnancy in newborn babies of mothers infected with Zika virus. During this 2007 outbreak, 49 confirmed and 59 probable cases of Zika virus infection have been recorded in this outbreak, while an estimated 440 000-1 300 000 cases have been documented in the most recent outbreak in Brazil.The alarming scale of the current outbreak and the potential for autochthonous transmission of this virus in North America and elsewhere have increased understanding of this emerging mosquito-trit virus[7]



Evolutionary relationships of Zika virus and other flaviviruses based on the whole polyprotein. [8]

Epidemiology

Originally, the Zika virus was isolated from a sentinel monkey placed on a platform in the Zika Forest near Entebbe, Uganda. In 1947, the first sample from which the Zika virus was isolated was obtained, and in 1948, when the virus was isolated from a pool of Aedes africanus mosquitoes obtained in the same forest, a second isolation of the virus was achieved. Intracerebral inoculation of the virus to monkeys in one of the five monkeys studied resulted in only moderate fever. [8] high levels of neutralising antibodies were found in about 6 percent of individuals examined in a concurrent serological survey, and antibodies were found in one of 15 monkeys examined. Specimens were taken from a child attending a health clinic in Kampong Speu Province, Cambodia in 2010, which subsequent tests found positive for Zika virus.[9] The child had mild symptoms (fever, sore throat, cough, and headache, but no maculopapular rash) and did not need to be admitted to the hospital. Around this time, no other cases of Zika virus infection were recorded, and this was the only positive non-dengue, non-Japanese encephalitis Flavivirus infection observed, while approximately 10,000 blood and throat swab samples were screened as part of the surveillance programme of US Naval Medical Research Unit. The global prevalence of Zika virus infection has not been widely reported owing to asymptomatic clinical course, clinical resemblance to other infection with other flaviviruses (dengue, chikungunya), and difficulty in confirming diagnosis. Based on sporadic case reports, entomological surveys, and seroprevalence surveys, Zika virus infection had been reported in various hosts, including humans, primates, and mosquitoes, in 14 countries across Africa, Asia, and Oceania, as of 2014. Zika viral infection has been registered in more than 28 countries with the highest number of infections in Brazil in 2016. The latest outbreak in Brazil began in the month of April, in the year 2015. The town of 'Natal,' located in the state of Rio Grande do Norte in the northeast of Brazil, registered the first case of infection with ZIKV[10]. Shortly afterward, virus spread throughout the country and frequent reports of microcephaly coincided with ZIKV infections.[11-12]

Transmission

Zika virus is transmitted to humans mainly through the bite of infected Aedes mosquito species (Ae.aegypti and Ae.albopictus). These are the same mosquitoes which spread dengue and chikungunya viruses. A pregnant woman can transfer Zika virus to her foetus during pregnancy. Zika is a cause of microcephaly and other significant foetal abnormalities of the brain. We're researching the full range of other potential health problems that Zika virus infection can cause during pregnancy.A pregnant woman who has already been infected with Zika virus will transmit the virus to her foetus during pregnancy or around the time of birth [13]. Zika virus has been discovered in breast milk. Possible infections of the Zika virus in breast-feeding infants have been reported, but transmission of the Zika virus via breast milk has not been confirmed. In addition, we do not yet know the long-term effects of Zika virus on young infants that have been infected after birth. Since existing research shows that the benefits of breastfeeding outweigh the risk of Zika virus transmission by breast milk, CDC tends to encourage mothers to breastfeed, even though they have been infected or lived in or travelled to areas at risk of Zika. Aedes aegypti and Aedes albopictus were recognized as major vectors for transmission of Zika virus. Since then, the infection has spread rapidly to several other countries, becoming a pandemic. The main mode of transmission is through the bite of an infected mosquito, although few sexual transmission events have been reported [14]. The risk of infection depends therefore on the local risk of mosquito-borne transmission. It may be high during epidemics, but lower levels of ongoing virus circulation are still expected in areas where ZIKV circulation is considered endemic; in these areas the risk of is low to medium. Sexual transmission among humans has also been described[15]. In addition, great concern is emerging over congenital malformations due to trans-placental transmission of Zika virus, including microcephaly and various ophthalmic abnormalities[16]. Zika can be passed through sex from a person who has Zika to his or her partners. Zika can be passed through sex, even if the infected person does not have symptoms at the time. There have been several accounts of potential cases of blood transfusion in Brazil. During the French Polynesian outbreak, 2.8% of blood donors tested positive for Zika and in previous outbreaks, the virus was detected in blood donors[17].

Pathophysiology

Zika virus is well-adapted to grow in various hosts, ranging from arthropods to vertebrates. Viral attachment to unidentified cellular receptors is mediated by the E (envelope) glycoprotein. This is followed by endocytic uptake and then uncoating of the nucleocapsid and release of viral RNA into the cytoplasm. A viral polyprotein is produced and modified by the endoplasmic reticulum. Immature virions collect both in the endoplasmic reticulum and in secretory vesicles before being released[21].

Clinical symptoms

Zika is usually mild with symptoms lasting from days to weeks. People usually don't get sick enough to go to the hospital, and very rarely die of Zika. For this reason, many people may not realise that they have been infected. Symptoms of Zika are similar to other viruses transmitted by mosquito bites, such as dengue and chikungunya. Zika virus typically stays in the blood of an infected person for around a week. If you develop symptoms and live in or have recently travelled to a Zika-risk location, see your doctor or other health care provider. Your doctor or other health care provider can order a blood or urine test to help decide if you have Zika. If a person is infected, he or she is likely to be safe from potential infections[22]. The spectrum of Zika virus disease overlaps with that of arboviral infections, but rash (maculopapular and potentially immune-mediated) is usually predominant. Rash in Zika virus infection is typically a fine maculopapular rash that is diffusely dispersed. It can include the face, trunk, and extremities, including palms and soles. Occasionally, the rash may be pruritic. Rash, along with other symptoms, typically develops within 2 weeks of travel to the infected region of the Zika virus. Zika virus rash typically develops in the first week of infection, with infection itself lasting from days to weeks. Zika virus infection should therefore be regarded among individuals with acute myelitis who reside in or travel from endemic areas of Zika virus.

Laboratory investigations

Zika virus infection is diagnosed based on the identification and isolation of Zika virus RNA from serum using reverse transcriptase polymerase chain reaction (RT-PCR). During the initial week of illness, the greatest sensitivity of PCR testing is marked by high viremia. Serological tests for virus-specific immunoglobin M (IgM) and anti-Zika virus neutralising antibodies can be performed after the initial week of illness using the enzyme-linked immunosorbent assay (ELISA)[19-20]. Diagnosis of Zika virus infection is generally focused on serological tests, but the CDC is now recommending the tests of urine. Urine can be tested using real-time reverse transcription polymerase chain reaction (rRT-PCR) samples obtained less than 2 weeks after onset of symptoms.

Treatment

There are no specific treatment options for Zika virus infection only symptomatic. Recent study on therapies has shown promising results by inhibiting ZIKV infections. These include limiting the entry of virus into cells, targeting ZIKV helicase protein, to terminate nascent RNA strand formation by using nucleoside analogs like 7-deaza-2'-C-methyladenosine and 2′ -C-methylated nucleosides and use of antibodies that do not neutralize but bind to ZIKV thereby reducing risk of ADE. The application of ZIKV therapies is of concern due to ADE especially in geographical regions where there is endemicity of other flaviviruses. Thus, to reduce ADE humanized mAbs with modification in Fc region are being genetically engineered which can prevent ADE.

Prevention and control

There is no vaccine for zika virus. The best way to prevent infection with Zika virus is to avoid travel to areas with active transmission of Zika virus. Residents living in endemic areas or visitors to endemic areas are recommended to prevent mosquito bites. Various methods to avoid mosquito bites include wearing full-sleeved shirts and long pants, sleeping under a mosquito bed sheet, and clothing treatment with permethrin. Mosquito-repelling agents such as DEET, picaridin, IR3535, and para-menthane-diol can be used in all age groups except those younger than 2 months for the prevention of mosquito bites. Mosquito larval habitats can be managed by the careful handling of water containers, including routine discarding or covering stagnant water or by the use of larvical agents[23].

Clinical trials

There is no vaccine for zika virus till now; there are ongoing clinical trials on Zika virus vaccine. One trial was randomised control study which involved with the Zika virus wildtype (ZIKVwt) DNA vaccine (VRC-ZKADNA090-00-VP) or placebo (VRC-PBSPLA043-00-VP). This study evaluated immunogenicity, safety and efficacy of 3-dose vaccine regimen and has completed phase 1 and is into phase 2[24]. The study VRC 319 trial assessed plasmid VRC5288 (Zika virus and Japanese encephalitis virus chimera), and VRC 320, done in one centre, assessed the plasmid VRC5283 (wild-type Zika virus). The study VRC5283 was done in centres, well tolerated and advanced now to phase 2 efficacy testing[25]. Another clinical trial is on rZIKV/D4Δ 30-713, developed by scientist in NIAID's Laboratory of Viral diseases. A chimeric virus was created by mixing genes from many viruses. The chimeric virus was made up of Dengue virus type 4 backbone that expresses Zika virus surface protein. The chimeric virus is a live virus which is weakened so that it cannot infect the receivers. The scientists are planning to add Zika component to the Dengue vaccine participants to create and evaluate a single vaccine which can protect both all four Dengue viruses and Zika virus. This vaccine is in phase 3 testing in Brazil. ZPIV a purified inactive zika vaccine was developed by Walter Reed Army Institute of Research and this study is in phase 1trial. AGS-v a investigational vaccine was developed by SEEK, a London based pharmaceutical company. It was designed to trigger immune response to salivary proteins in mosquito rather than to parasites or specific virus carried by the mosquito. This study is in phase 1 stage of clinical trial[26].

CONCLUSION

Zika viral infection is now included as newly emerging virus infection, which has a potential to cause serious public health problem. Zika virus does not pose a threat to adults but has potential to cause foetal abnormalities if pregnant mother is

affected. This is unlike other newly emerging infections, which have potential to cause serious morbidity or mortality in pediatric or adult population. Zika virus is unique among four PHIEC declarations by WHO, as it belongs to TORCH group of pathogens. Increased awareness among medical community along with better disease surveillance system and vector control are utmost important for controlling potential ZIKA virus infections in many countries.

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CONFLICT OF INTEREST
Conflict of interest declared none.

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SP-41

Occurrence of Oral Health Beliefs, Myths And Misconceptions Among Nomadic Narikuravar (Gypsie) Population, Vallioor, Tirunelveli District.

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Abstract: India, a developing country faces many challenges in rendering oral health needs. Indian population consists of people from different cultural backgrounds and there is a very strong influence of the various myths on health seeking behaviour in our population. In earlier times the Narikuravars' role in the village was that of a transient people, they now, in some respects, occupy a position comparable to that of other low caste groups, and they act as voters, as well as members, of the panchayat, the traditional village council. Permanent settlement has enabled Narikuravar children to go to school. The purpose of the present study was to find out the current prevalence of these cultural taboos and beliefs regarding dentistry among the Nomadic Narikuravar population who residing in Tirunelveli district. The intent is that this assessment will be helpful in shaping the future health programs and creating dental awareness among the Narikuravar community. The aim of the study was to explore cultural beliefs and taboos, misconception regarding dentistry among Nomadic Narikuravr (Gypsie) population residing in Valliyoor, Tirunelveli district. The study revealed poor knowledge, attitude and practices regarding oral health in Nomadic Narikuravar (gypsie) population, the cultural beliefs are due to illiteracy and lack of knowledge and they act as access barriers for the utilization of dental services.

Keywords: Narikuravar, Cultural Beliefs, Taboos, Gypsie.

INTRODUCTION

India, a developing country faces many challenges in rendering oral health needs. The majority of Indian population resides in rural areas[1]. Indian population consists of people from different cultural backgrounds and there is a very strong influence of the various myths on health seeking behaviour in our population. People believe in spiritual treatment and alternative forms of medicine, instead of coming to a dentist. In ancient times health and illness were interpreted in a cosmological and anthropological perspective. Medicine was dominated by magical and religious beliefs, which were an integral part of ancient cultures and civilizations[2]. Due to the lack of knowledge, the primitive man attributed disease and, in fact, all human sufferings and other calamities to the wrath of Gods, such as the invasion of body by "evil spirits". The concept of disease in which ancient man believed is known as the "supernatural theory of disease"[3]. All people, whether rural or urban, have their own beliefs and practices concerning health and disease [4]. Among these population The Narikuravar are thought to have migrated around 400 years ago from northern India to the south; their language (vagriboli) indicates a Gujarati origin. Until a few decades ago, they were nomadic groups of a few families would wander on more or less fixed routes, living through hunting, fortune telling, selling medicines, honey, plastic combs, and tattooing in the local temple festivals[5].

Fig 1: Narikuravar colony

After independence, they were given small plots and houses in newly Constructed settlements called colonies due to the revision of Indian settlement policies. Today there are around 900 so called Narikuravar colonies in Tamil Nadu, ranging from 20 to 400 houses in size. Permanent settlement has led to a number of changes among the Narikuravar. First of all, their subsistence patterns have changed: hunting, once a principal means of living, can now only be carried out privately, due to the passing of environmental laws restricting the commercial hunting of most species. As an alternative, the catching of rats from rice fields has become an important source of income for local peasants. Being permanently located in one place has, of course, also had an impact on the relationship of the Narikuravars with the Tamil population.

Fig 2: Narikuravar colony

Whereas in earlier times the Narikuravars' role in the village was that of a transient people, they now, in some respects, occupy a position comparable to that of other low caste groups, and they act as voters, as well as members, of the panchayat, the traditional village council. Permanent settlement has enabled Narikuravar children to go to school. There, they mix and make friends with Tamil children, and they learn to speak, read, and write in the Tamil language[5]. Gradually with the development of education, these taboos and beliefs are disappearing, but still they persist and are commonly encountered. The field of dentistry is not exceptional to these cultural beliefs. Regarding tooth and tooth ache there have been various superstitions; the popular ones are described in this study. Traditional Indian beliefs and taboos were found to correlate inversely with preventive dental health behaviour in the population [6]. The purpose of the present study was to find out the current prevalence of these cultural taboos and beliefs regarding dentistry among the Nomadic Narikuravar population who residing in Tirunelveli district. The intent is that this assessment will be helpful in shaping the future health programs and creating dental awareness among the Narikuravar community. The aim of the study was to explore cultural beliefs and taboos, misconception regarding dentistry among Nomadic Narikuravr (Gypsie) population residing in Valliyoor, Tirunelveli district.

MATERIALS AND METHODS

STUDY DESIGN

This present study was a cross-sectional survey done to assess the Oral Health Beliefs, Myths and Misconceptions among Nomadic Narikuravar (Gypsie) population.

INFORMED CONSENT

Verbal consent was obtained from all the study participants.

BACKGROUND OF THE STUDY AREA AND STUDY POPULATION

This cross-sectional survey was conducted among Narikuravar colony, Valliyoor, Tirunelveli district, India. The total population of the Narikuravar colony is 212 and total number of houses 61, and the majority of the population relying on bead jewellery making, honey sales, plastic combs, hunting, tattooing for their income.

STUDY PERIOD

This study was carried out during the month of June 2015.

INCLUSION AND EXCLUSION CRITERIA

Above 15 years old were included in this study.

- Those who are not willing to participate were excluded.

QUESTIONNAIRE FORMULATION

A close ended, structured questionnaire written in English including 13 items was designed to evaluate cultural beliefs and taboos regarding oral health care. The questionnaire was modified based on the results of the pilot study. Examples of

information that was gathered includes: personal sociodemographic characteristics, extraction of upper teeth and its effect on eye sight, worms in the teeth as shown by unqualified doctors, loosening of teeth after oral prophylaxis, neonatal teeth being dangerous for grandparents, spacing between upper anteriors as a sign for good fortune, etc.

Fig 3: Recording the questionnaire by the investigator

STATISTICAL ANALYSIS

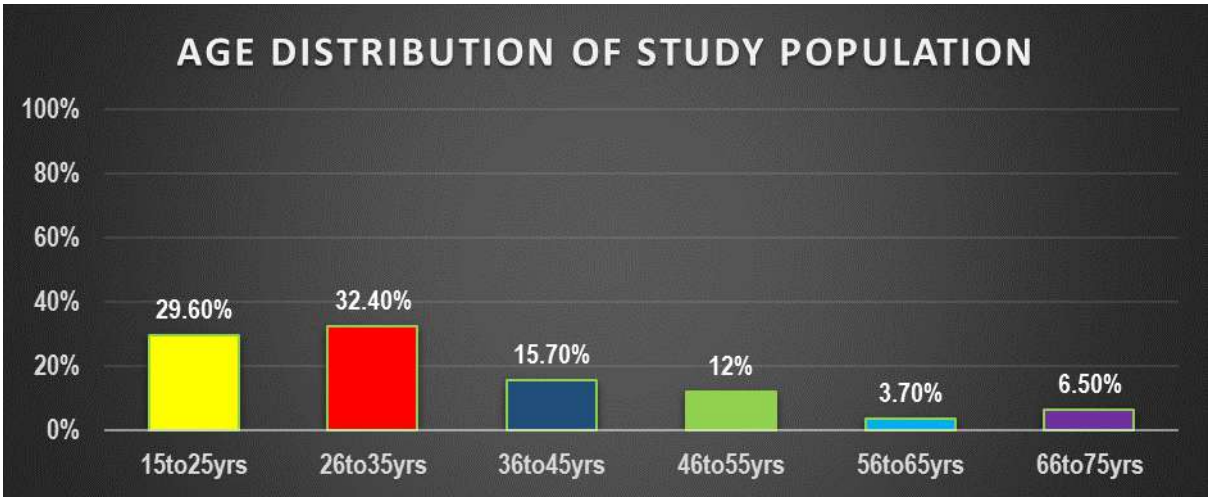
Data analysis was done using SPSS version 15.0. Descriptive statistics were obtained and frequency distribution, means, standard deviation were calculated. Positive mean scores of all the questions were calculated using student's *t* and One-way ANOVA test at p value < 0.05. Pearson's correlation coefficient was used to assess the relation of age group and dental visit.

RESULTS

The total sample was 108, which was assorted according to age, gender to know misconception regarding dental health. Table 1 shows that most of the participants (85.2%) think that after cleaning teeth get loosen. Most of the participants (91.7%) believe that extraction of upper teeth affects eye sight. Nearly (93.5%) of our subjects believe that there is no need to visit a dentist until all the permanent teeth of children erupt. (84.3%) of the participants feels no need of dental visit even if there is no problem.

TABLE 1: AGE WISE DISTRIBUTION

AGE	FERQUENCY	PERCENTAGE
15to25yrs	32	29.6
26to35yrs	35	32.4
36to45yrs	17	15.7
46to55yrs	13	12.0
56to65yrs	4	3.7
66to75yrs	7	6.5

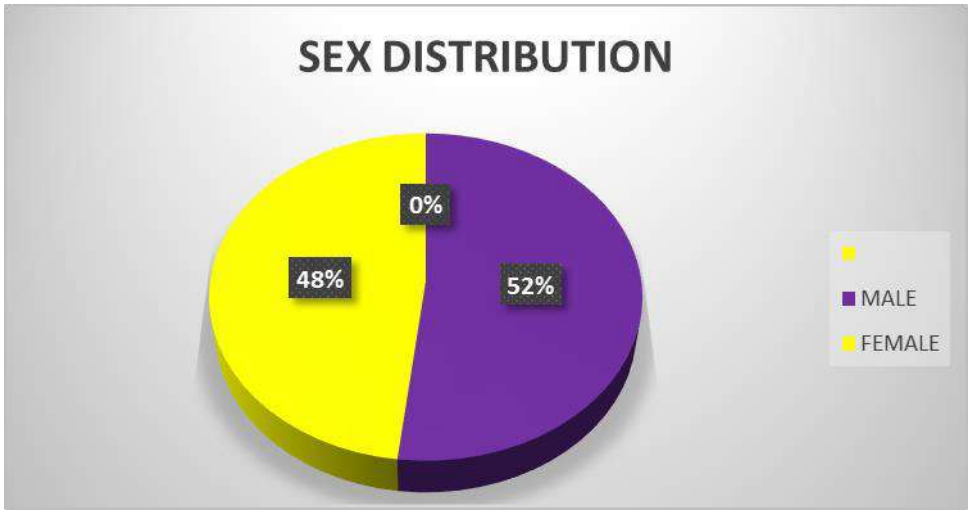


GRAPH 1 SHOWS AGE DISTRIBUTION OF THE NARIKURAVAR POPULATION.

When it was asked about spacing between upper anterior teeth as an indication for good fortune, less than (67.6%) subjects gave correct response, 85.2% of the study participants says brushing teeth with finger is better than tooth brush, 98.1% of the population says hard brush cleans the teeth appropriately, 85.2% of the study participants says clove, supari are effective medicine for tooth ache, 70.4% of the population says not to use charcoal, Salt, rice, brick powder, tobacco, husk for cleaning the teeth, 99.1% of the participants says they will brush even though there is a bleeding gums, 65.7% of the participants says original teeth were better than artificial one, 96.3% of the population were not visited to a dentist, 65.7% of the participants thought the female dentist will not treat their teeth as finely as a male dentist, 85.2% of the participants were thought white teeth are stronger. 96.3% of the participants were says taking medicines after food.

TABLE 2: GENDER DISTRIBUTION

SEX	FERQUENCY	PERCENTAGE
MALE	56	51.9
FEALE	52	48.1



GRAPH 2 SHOWS GENDER DISTRIBUTION OF NARIKURAVAR POPULATION

Table 3: question for Assessing knowledge regarding Beliefs, Myths and Misconception on Oral Health among Narikuravar (gypsie) Population.

S.NO	QUESTION ASKED	YES		NO	
		frequency	percent(%)	frequency	Percent(%)
1.	Do teeth become loose after cleaning?	92	85.2%	16	14.8%
2.	Do you think extraction of upper teeth potentially affects aye site?	99	91.7%	9	8.3%
3.	Do you think there is no need to visit dentist before all the primary (milk) teeth were appeared?	101	93.5%	7	6.5%
4.	Do you think there is no need to visit dentist for treating milk teeth and how they are going to shed off?	91	84.3%	17	15.7%
5.	Is there a need of regular dental check up even if there is no problem?	17	15.7%	91	84.3%
6.	Do you think spacing, crowding, irregular placement between teeth is a sign of good luck?	35	32.4%	73	67.6%
7.	Do you think cleaning teeth with fingers is better than with brush?	92	85.2%	16	14.8%
8.	Do you think hard brush cleans your teeth more appropriately than soft brush?	106	98.1%	2	1.9%
9.	Do you think cloves and supari should be used to ease tooth pain?	92	85.2%	16	14.8%
10.	Do you think charcoal, salt, rice, husk, tobacco etc in powder form is better than toothpaste in cleaning teeth?	32	29.6%	76	70.4%
11.	Do you think when the gums bleed, it is better not to brush the teeth?	1	0.9%	107	99.1%
12.	Do you think it is better to have artificial teeth than to repair ones original teeth?	37	34.3%	71	65.7%
13.	Have you visited a dentist	4	3.7%	104	96.3%

A large portion of the Narikuravar population has cultural beliefs, misconceptions, myths related to oral health. Among these population 15-25 years old (59.4%) were visited a dentist more frequently than other age groups were statistically significant [p<0.00].

TABLE 4: Shows Age versus Dental Visit.

AGE	VISITED	NOT VISITED
15to25yrs	59.4%	40.6%
26to35yrs	14.3%	85.7%
36to45yrs	23.5%	76.5%
46to55yrs	23.1%	76.9%
56to65yrs	0.00%	100%
66 TO 75YRS	0.00%	100%

Chi Square -23.117 df-5 p-0.00

DISCUSSION

India is a land of various cultures there are around 900 so called Narikuravar colonies in Tamil Nadu, ranging from 20 to 400 houses in size. India is a vast country with a varied ethnic, socio-economic and geographical background[7]. To address the fact that no study exists regarding cultural beliefs and taboos related to dentistry, we conducted this study. Every culture has its own customs, some of which have a profound influence on incidence of disease [8, 9]. In the present study the individual who lives in Narikuravar colony were illiterate, myths and misconception level is high in older age groups than the younger age groups. These finding were similar to study conducted by (Chen et al 1983) [10]. In this study overall 85.2% of the respondents think that after oral prophylaxis teeth will loosen, this may be attributed to the fact that many people from rural areas have little knowledge about dental treatments. They tend to visit the dentist at advanced stages of disease, and at that time, if a dentist removes calculus it may be likely that the tooth will become more mobile. This loosening could lead the patient to consider the dentist as the cause [11]. In present study around half of the respondents believe that extraction of upper teeth deleteriously affects eye sight. For example, extractions performed on older patients, leading to weakening of eye sight due to its vicinity in maxilla. In this study 93.5% of study subjects believe that there is no need to go to dentist until all the permanent teeth of child erupts. This is not entirely true as early loss of milk teeth will interfere with chewing and affect the child's nutrition, leads to drifting of the adjacent teeth and closure of some of the space that is required for the succeeding permanent teeth to erupt into. Such a loss of space will cause the permanent teeth to erupt in irregular position and result in crowding. Therefore milk teeth need to be cared for as much as permanent teeth[12]. So it is advisable to start the habit of cleaning the infant's teeth soon after they appear in the mouth. In fact it is advised to clean baby's gum pads everyday by gentle massage even before the teeth erupt. More than 84.3% of participants think that there is no need of a regular dental check-up even if there is a problem because dental diseases are not life threatening and can be taken care of with routine medicines available through local pharmacy without consultation of dental surgeon. Some people are quite poor who cannot afford high cost dental treatments[13]. In the present study 32.4% of the participants were think that spacing, crowding, irregular placement between teeth is a sign of good luck similar study stated The presence of natal teeth was related with supernatural powers, ill-luck and most of them believed that the child would bring misfortune to the family and would become a witch. These kinds of beliefs are considered to be carried out from the ancestors, most often to the females of the family[14]. In the present study, 50% of the subjects still do not have appropriate brushing habits, which may be due to poor education. Many people in the Narikuravar community use twigs of neem tree as a tooth brush, some use ashes, and some charcoal. Similar study stated that Orthodox Jains clean their teeth using fingers and without using the brush. This may have a negative impact on their oral health. Muslims offer prayer in the form of namaz, five times in a day. During each namaz, as part of the ritual, they use miswack stick, tooth picks and do gum massaging. This may promote the oral health. Use of chewing twigs, Neem/ Banyan/coconut twigs/datun /twigs from Salvaodora Persicca are used for cleaning the teeth[15]. 85.2% of the participants using products like clove and supari for relieving tooth pain and materials like charcoal. Similar study stated that However in some countries habits of cola and khat chewing are widely prevalent. The cola has tannin and caffeine that facilitates healing of oral mucosal lesions but both of them causes dry mouth, thirst, pain, and clicking in the Tempero Mandibular Joint region[16].

CONCLUSION

The study revealed poor knowledge, attitude and practices regarding oral health in Nomadic Narikuravar (gypsie) population, the cultural beliefs are due to illiteracy and lack of knowledge and they act as access barriers for the utilization of dental services. Co-ordinated efforts by dentists, Public Health Specialists, Non Government Organisations (NGO's) and grass root level workers are needed to impart dental health education that can be effectively incorporated in developmental programmes in promoting the prevention of diseases and dental care among this Narikuravar (gypsie) population.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-42

Oral Health Related Quality Of Life – A Brief History And Its Impact And Importance In Dentistry

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Abstract : Health is defined as "a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity" by World Health Organization (WHO) in 1948. According to WHO, the determinants of health include the physical environment, the person's individual characteristics and behaviors and social and economic environment thus capturing both quantity and quality of life. The concept of Quality of Life was introduced in the medical literature in 1966 by Elkington, prior to that the disease was usually measured in quantity i.e. the prevalence of disease. With the advent of life-saving drugs and procedures, the life expectancy was increased and so did the side-effects for some of them. This impelled the physicians to assess the treatment on the basis of risk versus benefits, efficiency and efficacy. The concept of Oral Health Related Quality of Life was introduced by Locker D in 1988. Since then, numerous indices have been developed by various authors to measure the OHRQoL. In 2011, Sischo and Broder suggested the following purposes for growing importance of quality of life in dental practice. Firstly, the patient now a day has more active role in decision making regarding the various health care procedures as a treatment team member and has the freedom of thought, intention and action when making decisions. Secondly, there is a constant rise in the health care practices for evidence-based approaches and thirdly, the fact that many treatments for chronic diseases keep the underlying health condition under control but fail to cure the same. Thus, it is recommended that the assessment and impact of presenting dental disease on Oral Health Related quality of life should be part of diagnosis by the dentist to give holistic care to the patient.

Keywords: Oral Health, Patient care, Health Care Quality Assessment, Dental Informatics, Patient-Relevant Outcomes

ORAL HEALTH RELATED QUALITY OF LIFE

INTRODUCTION

The World Health Organization (WHO) in 1948 has defined health as "a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity". Thus, according to WHO, the determinants of health include the physical environment, the person's individual characteristics and behaviors and social and economic environment thus capturing both quantity and quality of life.[1] Oral cavity is regarded as the gateway to our body. Health of the oral cavity is recognized by WHO as an essential part of the general health.[2] Various oral diseases include gingivitis, periodontitis, dental caries and its sequelae, traumatic dental injuries, malocclusion, congenital malformations, oral lesions and cancers. These oral diseases and conditions present themselves with variety of signs and symptoms ranging from sensitivity to pain, swelling to psychological effects; thus, having a broad spectrum of impact on health and wellbeing of an individual.[2]Furthermore, systemic conditions traversing from allergies to metabolic diseases, syndromes to nutritional deficiencies, diseases of skin to nerves and musculoskeletal system also exhibit oral manifestations.[3] Traditional indicators for dental diseases usually measure and classify only the clinically visible, physical components of a disease. For example, for dental caries, DMFT/DMFS (Decayed, Missing, Filled Teeth/ Decayed, Missing, Filled Surfaces) is used which measures the number of teeth/ surfaces with dental caries, number of teeth/ surfaces missing due to dental caries and number of teeth/ surfaces with filling due to dental caries; Russell's Periodontal Index estimates deeper periodontal disease by measuring the presence or absence of gingival inflammation and its severity, pocket formation and masticatory function; Community Periodontal Index (CPI) modified uses two indicators of periodontal status namely gingival bleeding and periodontal pockets using a specially designed, lightweight CPI metallic probe. This index measures the absence or presence of gingival bleeding and absence or presence of pockets. For malocclusion, Angle's system of classification divides occlusion into broad categories namely class I, class II (division 1 and division 2) and class III based on the relationship of maxillary and mandibular first molars and Index of Orthodontic Treatment Needs (IOTN) assesses the grade of orthodontic treatment need among children and adults. However, few oral conditions such as malocclusion and traumatic dental injury not only have effect on physical appearance but also can have psycho-social effects influencing self-esteem, socializing and interpersonal relationships of an individual, thus affecting Oral Health Related Quality of Life (OHRQoL).[4,5,6] Also, many researchers believe that only a clinical examination of a patient for malocclusion is not sufficient and OHRQoL should also be assessed to recognize the psycho-social effect on the individual.[7]

EARLIER PERSPECTIVE OF QUALITY OF LIFE

Traditionally, public health has been concerned with mortality.[8] The public health frameworks that were in operation during the first half of 20th century were developed to help deal with the complex patterns of untimely mortality, and, to a lesser extent,

the incidence and prevalence of morbidity. In other words, the field of medicine focused its attention primarily on quantity of life but not on the quality (QoL). The term QoL was first mentioned in the medical field by Elkington in 1966. The emerging newer technologies, particularly the procedure of chronic dialysis and organ transplantation, raised new queries in the mind of clinicians for example how does a physician guard the proper quality of life of an individual patient etc. The term QoL was then introduced as a keyword in the Medical Subject Headings (MeSH) of the US National Library of Medicine MEDLINE Computer Search System in 1977. It was then defined as "a generic concept reflecting concern with the modification and enhancement of life attributes, e.g., physical, political, moral and social environment; the overall condition of a human life."[8]The physicians started using QoL during the 1970s, for making decisions regarding health issues. The practice of medicine has always involved dilemmas, tragic or painful choices. Furthermore, with the innovation of tests such as prenatal diagnosis, physicians utilized QoL to assess which fetuses to abort and which to save. With the advent of life-saving drugs and procedures, the life expectancy was increased and so did the side-effects for some of them. This impelled the physicians to assess the treatment on the basis of risk versus benefits, efficiency and efficacy.[8]Further, WHO has defined Quality of Life (QoL) as "the product of the interplay between social, health, economic and environmental conditions which affect human and social development. It is a broad ranging concept incorporating a person's physical health, psychological state, level of independence, social relationships, personal belief and relationship to salient features in environment".[9]

ORAL HEALTH RELATED QUALITY OF LIFE

The concept of Oral Health Related Quality of Life was introduced by Locker D in 1988.[10] Since then numerous indices have been developed by various authors to measure the OHRQoL. If we observer trospectively, we find a delay of about two decades in the development of OHRQoL. The delay in the development of OHRQoL could be due to the deprived awareness of the impact of oral diseases on quality of life. Moreover, researchers had rejected the proposal that oral diseases could be related to general health till around 50 years ago.[11]In 1976, Davis P had asserted that only oral pain and life-threatening cancers had impact on social life of an individual and other oral conditions were only linked with cosmetic issues.[12] Similarly, other researchers have discussed that dental diseases were among others with frequent complaints such as headache, rash and burns and they were perceived to be unimportant that seldom contributed to the classic sickness and hence counted them not be a justification for exemption from work. As the evidence increased about role of oral health on social and psychological life, the concept of OHRQoL began to evolve. In 2011, Sischo and Broder suggested the following purposes for growing importance of quality of life in dental practice.[13] Foremost, the patient now has more active role to play in decision making regarding the various health care procedures as a treatment team member with the freedom of thought, intention and action when making decisions. Secondly, there is a constant rise in the health care practices for evidence-based approaches and finally, the fact that many treatment modalities for chronic diseases keep the underlying health condition under control but fail to cure the same. OHRQoL as "a multidimensional construct that reflects (among other things) people's comfort when eating, sleeping, and engaging in social interaction; their self-esteem; and their satisfaction with respect to their oral health."

Various Concepts of OHRQoL

Locker (1988) presented Conceptual framework of OHRQoL based on the WHO classification of impairment, handicap and disability. It attempted to record the psychosocial and functional consequences of poor health. For instance, edentulous people were considered impaired because of tooth loss and this resulted in disability of individual to perform daily tasks such as eating or speaking.[10] Later in 2011, Sischo and Broder developed a model for OHRQoL among children. They combined biological, social, cultural and psychological factors. This model was adapted from previously developed Wilson & Cleary model for QoL. Wilson and Cleary presented a conceptual model that was composed of five aspects: physiological factors, symptom status, functional health, general health perceptions and overall quality of life. They proposed that physiological variables influenced symptoms, which in sequence influenced functional health. The final health affects general health perceptions that affect eventually the overall quality of life.[13] The concept by Sischo and Broder has linked health status and/or clinical variables, functional status, oral-facial appearance, psychological status, OHRQoLwith overall QoL. In addition, this model also illustrated the effects of environmental factors, such as education, family income and structure, sociocultural factors and access to care on oral health perception and QoL.

Importance of oral health related quality of life

The better understanding of OHRQoL influences the clinical dental practice, dental research and dental education.

OHRQoL and Clinical Dental Practice

OHRQoL has a profound role in clinical dentistry. The knowledge about OHRQoL which renders into the clinicians' credit that they do not treat teeth and gums as separate entity but the human being as a whole. Besides, oral-related behaviour such as practicing good oral hygiene; the regular dental checkups and aesthetic dental care are motivated by OHRQoL. OHRQoL focuses clinician's attention to the patient as a whole and thus the care rendered is patient centered. It reminds basic and clinical researchers in the oral health sciences that the ultimate outcome of any intervention or treatment should be an improvement of a person's quality of life which can further support dental educators in their efforts to train patient-centered culturally sensitive future dentists. Understanding the relevance of a patient's chief complaint with patient's quality of life can be crucial in getting a clear sense of the patient's expectations concerning the treatment outcome. Even when providing oral hygiene instructions and health education in general, a consideration of the patient's quality of life may be one crucial factor that will ultimately determine if the patient will engage in the recommended course of action or not. Thus, OHRQoL can be used[11] in identifying and prioritizing problems, facilitating communication, screening for hidden complications facilitating shared clinical decision making and monitoring changes or responses to treatment.

OHRQoL and Dental Research The idea of OHRQoL is enormously important at all levels of dental research. Whether the research is basic scientific research or clinical study or community research; it makes a contribution to patient's overall health. The concept of OHRQoL is essential for research at community level as it promotes oral health care. The clinical indicators such as decayed, missing and filled teeth (DMFT) are better appreciated by a dentist rather than a layman as the DMFT score does not imply the extent of impact of dental caries on an individual's day to day life but at the same time, becomes an important data for a dentist. A layman on the other hand, may recognize the impact of dental caries if DMFT scores are illustrated in terms of diminished QoL as a consequence of dental caries such as inability to eat, sleep and carry out the regular activities because of the associated pain. Similarly, treating malocclusion from a dentist's point of view includes both aesthetic and functional aspects like satisfactory intercuspation among the maxillary and mandibular teeth, acceptable straightening of the facial profile, adequate masticatory function and correct pronunciation and speech. But from the patient's point of view the trouble might be 'just a little proclined teeth' which would have been affecting them socially and psychologically; in other words OHRQoL; for which they might have visited the dentist. For assessing the OHRQoL, intensive research had been carried out and various instruments have been developed which assist the dentist to assess the impact of oral disease on the patient's OHRQoL. Few of such instruments are The Geriatric Oral Health Assessment Index (GOHAI),[14] Rand dental health index,[15] dental impact profile,[16] Oral Health Impact Profile (OHIP),[17] subjective oral health status indicators[18] and dental impact on daily performance.[19] These instruments were developed for various oral conditions and for various age groups. A lot of studies have been conducted to assess the sensitivity and reliability of these instruments. Also, studies were conducted to check the validity of these instruments among various population age groups and various oral diseases. A few instruments were simplified into shorter versions for speedy assessment of the patient e.g. original OHIP-49 was simplified to OHIP-14.[20] The modified version was also found to be equally sensitive, reliable and valid. Further, studies on impact of oral diseases on OHRQoL provides data of the effect of oral diseases on the individual's routine life like absence from work,[21] inability to eat and sleep, psychology and social aspects. This data can be used to communicate with the concerned authorities to acquaint them with the importance of oral health and can thus be used to correspond with the government for allocation of funds for the prevention and treatment of oral diseases.

OHRQoL and Dental Education

The education imparted to the dental students about the OHRQoL could play a crucial role on how the forth coming dentist perceives the oral problem of the patient and thus how he/she plans the treatment for the same. The dental treatment can, as earlier mentioned, be culturally, socially and psychologically like being introvert affect the individual. Thus, the dentist needs to know and understand about the expectations of the patient from the treatment. The dentist should be able to present the treatment plan which will be optimal for the patient both clinically and personally. The individuals are more likely to behave positively when they recognize how oral diseases affect their general health and quality of life. This can be taught well during the teaching of dental curriculum. Presently dental curriculum does not does not teach much about OHRQoL.

CONCLUSION

It is recommended that the assessment and impact of presenting dental disease on OHRQoL should be part of diagnosis by every dentist and the oral health worker in order to give aholistic care to the patient.

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-43

Knowledge, Attitude And Practices About Dental Stem Cells Among Dental Professional And Students – A Cross Sectional Study

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Abstract: Dental pulpal stem cells are capable of producing tooth like structure including dentin and pulp in an in-vivo environment. Patient specific treatment focusing on regeneration and development of tissues by using stem cells has rapidly increased. Due to increasing demand and popularity it is necessary for the dental professionals to acquire adequate knowledge on the application of these dental stem cells in their practice.
A cross-sectional questionnaire survey was conducted among 312 dental professionals that included undergraduate and postgraduate dental students and dental practitioners. The required information was collected through a specially designed structured questionnaire, comprising 22 questions. Descriptive analysis with frequency, percentage, mean and standard deviation was computed. Pearson Chi-square test and Fisher's Exact test was used to assess the level of significance. Almost 63.8% of participants were aware that scientist Alexander Marksimov coined the term stem cells in dentistry, others with unsure options. About 27.5% of participants incorrectly responded to the source of dental stem cells as gingiva. There were no significant differences between males and females regarding the knowledge of dental stem cells. The awareness about stem cells was slightly more among females and this difference was statistically significant. ($p<0.050$). The present study clearly shows adequate knowledge and positive attitude towards dental stem cells however lack awareness and practice due to insufficient intensive training and failure to integrate regenerative therapy in the dental curriculum at the undergraduate level.

Keywords: Stem cells, Awareness, Knowledge, Dentists, Dental Pulp

INTRODUCTION

Stem cells also known as precursor or progenitor cells are capable of self-renewal and multi-lineage trans-differentiation and this term was coined by Wilson in 1908. Stem cells are categorized primarily into two types as embryonic stem cells (ESCs) and adult or somatic or postnatal stem cells (ASCs) depending on the source and differentiation. The adult stem cells have the capacity to differentiate into more than one cell type are acquired frequently from marrow of the bone, fat tissues, umbilical cord and pulpal tissue of the tooth. Over the recent years dental stem cells which are widely used are adult mesenchyme stem cells because of its feasibility and accessibility [1]. The sources of stem cells of dental origin include primary or permanent tooth germ, dental pulp stem cells, human exfoliated deciduous teeth, dental follicle stem cells, periodontal ligament stem cells, apical papilla stem cells and supernumerary teeth stem cells with varied application in regeneration of salivary gland tissue, temporomandibular joint [2] and biological tooth [3]. Studies have also shown that dental pulpal stem cells are capable of producing tooth like structure including dentin and pulp in an in-vivo environment [3]. Patient specific treatment focusing on regeneration and development of tissues by using stem cells has rapidly increased that led to new treatment approach in the field of surgeries, periodontal therapy and endodontic management [4]. Along with stem cells, signaling molecules and scaffolds together serve as an important element in regenerative engineering or tissue engineering. Signaling molecules includes growth factors and bone morphogenic proteins whereas scaffolds are extracellular matrix carriers that provide environment for growth, differentiation, adhesion and migration process [5]. Increasing progressive research and advancement in the field of stem cell therapy has significantly evolved chances of incorporating stem cell applications as a part of dental curriculum. Awareness among the general population about stem cell was largely by scientific publications in the television and other social media resources. Due to increasing demand and popularity it is necessary for the dental professionals to acquire adequate knowledge, specialized skill and awareness on the advantages, disadvantages and several other aspects on the application of these dental stem cells effectively and efficiently in their practice [2]. Hence the present study was aimed to assess the knowledge and awareness about stem cells among dental professionals.

Materials and Methods

A cross-sectional questionnaire survey was conducted among 312 dental professionals that included undergraduate and postgraduate dental students and dental practitioners across Tamil Nadu, India. The study protocol was submitted to the Institutional Review Board of Dr. MGR Educational and Research Institute, and its approval was obtained.

Questionnaire development

The required information was collected through published scientific articles pertaining to the study and specially designed structured questionnaire, comprising of 22 questions divided into 2 sections was prepared. The first section was used to record the demographic details such as age, gender, qualification, year of study/experience of practice. The second section consisted a combination of selected responses to certain questions and also few close ended questions (Yes / No/ don't know)

related to knowledge, awareness and practice towards stem cells in dentistry. The questionnaire was validated through a pilot study and it was found to have adequate reliability.

Sampling methodology and data collection

A non-probabilistic convenient sampling methodology was used to recruit the participants for the present study. Since this study was conducted during COVID-19 Pandemic lockdown period, online Google forms were generated and distributed through social media platforms. The questionnaire encompassed a separate section which explained the nature and purpose of the study along with an informed consent form. The respondents were requested to provide appropriate answers and were assured of anonymity and confidentiality. The filled questionnaire was collected and evaluated.

STATISTICAL ANALYSIS

The data was analyzed using Statistical Package for Social Sciences, IBM Corporation, SPSS Inc., Chicago, IL, USA Version 26 software package (SPSS). Descriptive analysis with frequency, percentage, mean and standard deviation was computed. Pearson Chi-square test and Fisher's Exact test was used to assess the level of significance at $p<.05$.

RESULTS

The present study is based on a questionnaire survey and circulated among dental professionals The sample consist total of 312 dental professionals out of which 60.4% were males and most of them were between 22-24 years of age with a mean age of 23.66. BDS graduates and dental practitioners under 5 years of experience were the most participants. Almost 63.8% of participants were aware that scientist Alexander Marksimov coined the term stem cells in dentistry, others with unsure options. About 27.5% of participants responded the source of dental stem cells as gingiva. When questioned about the best deciduous teeth to get enough stem cells majority of them are ignorant and 44.6% of them responded molars being the best deciduous tooth for the same. 49.1% of the study participants know that dental pulp stem can be seen in the cell-rich zone of dental pulp. Knowledge regarding the important role of stem cells in tooth reconstruction, 48.9% answered induced pluripotent stem cells and 36.5% as Hematopoietic stem cells. The result demonstrated that the majority have an idea about the optimum root length of the tooth to harvest the stem cells after extraction as full, whereas about 34.8% of them knew the optimum root length of a tooth to harvest the stem cells after extraction is half. Almost 41.9% felt that the procedure taken in dental stem cells is continued root formation and regeneration of enamel while very few are unsure about it. There were no significant differences between males and females regarding the knowledge of dental stem cells. Tables 3 describes the awareness and practices regarding dental stem cells. About 85.9% of dental professionals have known about the term stem cells. This study revealed 69.3% awareness about the application of dental stem cells. The awareness about stem cells were slightly more among females and this difference was statistically significant. About 42.5% of dental professionals have not believed that they have a purpose in dental stem cell banking. Less than 45.5% of the participants considered stem cells can be used for regenerative dental treatment. The main source of information was journals as 33.5% and almost two sources selected more than one source of information. It was observed that 50.5% of dental professionals have attended a training course on dental applications of stem cells. Nearly half of the participants have attended seminars on stem cells. The majority 86.6% are willing to save teeth dental tissues for future regenerative dental treatment.

Table 1: Demographic details of the study population

Age	Mean	23.66
	Minimum	18
	Maximum	30
Gender	Male	189(60.4%)
	Female	124(39.6%)
Qualification	BDS	118(37.7%)
	MDS	30(9.6%)
	PG students	66(21.1%)
	UG students	99(31.6%)
Year of study/experience	3rd Year BDS	46(14.7%)
	Final year BDS	32(10.2%)
	Intern	68(21.7%)
	postgraduate	74(23.6%)
	Dental practitioners under 5 years of experience	82(26.2%)
	5-10 years of experience	10(3.2%)
	More than 10 years of experience	1(0.3%)

Table 2: Distribution of study subjects according to their knowledge on dental stem cells

Questions		Gender		Total	P value
		Male	**Female**		
The scientist who coined the term stem cells.	Alexander Marksman	117(61.9%)	82(66.1%)	199(63.8%)	0.123
	Claude Galen	6(3.2%)	10(8.1%)	16(5.1%)	
	Trendley H Dean	35(18.5%)	16(12.9%)	51(16.3%)	
	Don't know	31(16.4%)	16(12.9%)	47(15.0%)	
The sources of dental stem cells.	All of the above	50(26.5%)	34(27.4%)	84(26.8%)	0.973
	Apical papilla	48(25.4%)	30(24.2%)	78(24.9%)	
	Dental pulp	38(20.1%)	27(21.8%)	65(20.8%)	
	Gingiva	53(28.0%)	33(26.6%)	86(27.5%)	
The best deciduous teeth to extract to get enough number of stem cells.	Canine	49(25.8%)	29(23.4%)	78(24.9%)	0.894
	Central	39(20.6%)	25(20.2%)	64(20.4%)	
	Don't know	17(9.0%)	14(11.3%)	31(9.9%)	
	Molar	84(44.4%)	56945.2%)	140(44.7%)	
Dental pulp stem cells can be seen in.	Cell-free zone	27(14.3%)	17(13.7%)	44(14.1%)	0.761
	Cell rich zone of dental pulp	83(43.9%)	48(38.7%)	131(41.9%)	
	Don't know	15(7.9%)	10(8.1%)	25(8.0%)	
	The pulp core	64(33.9%)	49(39.5%)	113(36.1%)	
An important role of stem cells in tooth reconstruction.	Don't know	12(6.3%)	10(8.1%)	22(7.0%)	0.577
	Hematopoietic stem cells	54(28.6%)	27(21.8%)	81(25.9%)	
	Induced pluripotent stem cells	89(47.1%)	64(51.6%)	153(48.9%)	
	Mesenchymal stem cells	34(18.2%)	23(18.5%)	57(18.2%)	
The optimum root length of a tooth to harvest the stem cells after extraction.	Full	69(36.5%)	40(32.3%)	109(34.8%)	0.662
	Half	88(46.6%)	64(51.6%)	152(48.6%)	
	Don't know	32(16.9%)	20(16.1%)	52(16.6%)	
A procedure used in dental stem cells.	Both a and b	69(36.5%)	62(50.0%)	131(41.9%)	0.065
	Continued root formation	33(17.5%)	17(13.7%)	50(16.0%)	
	Don't know	10(5.3%)	9(7.3%)	19(6.1%)	
	Regeneration of enamel	77(40.7%)	36(29.0%)	113(36.1%)	

Table 3: Distribution of study subjects according to their awareness and practices on dental stem cells

Questions		Gender		Total	P value
		Male %	**Female %**		
Awareness of the term stem cells.	No	34(18.0%)	10(8.1%)	44(14.1%)	0.013*
	Yes	155(82.0%)	114(91.9%)	269(85.9%)	
Awareness of the term dental stem cells.	No	65(34.4%)	31(25.0%)	96(30.7%)	0.078
	Yes	124(65.6%)	93(77.05)	217(69.3%)	
The purpose of dental stem cell banking.	Don't know	58(13.7%)	27(21.8%)	85(27.2%)	0.219
	No	77(40.7%)	56(45.2%)	133(42.5%)	
	Yes	54(28.6%)	41(33.1%)	95(30.4%)	
Stem cells can be used for regenerative dental treatment.	Don't know	32(16.9%)	19(15.3%)	51(16.3%)	0.570
	No	89(47.1%)	53(42.7%)	142(45.4%)	
	Yes	68(36.0%)	52(41.9%)	120(38.3%)	
Source of information about stem cells.	Colleague	38(20.1%)	34(27.4%)	72(23.0%)	0.310
	Internet	39(20.6%)	23(18.5%)	62(19.8%)	
	Journals	62(32.8%)	43(34.7%)	105(33.5%)	
	Seminar	50(26.5%)	24(19.4%)	74(23.6%)	

Attended any training course of dental application of stem cells	No	95(50.3%)	60(48.4%)	155(49.5%)	0.745
	Yes	94(49.7%)	64(51.6%)	158(50.5%)	
Attended Seminars on stem cells.	Don't know	30(15.9%)	16(12.9%)	46(14.7%)	0.737
	No	62(32.8%)	44(33.5%)	106(33.9%)	
	Yes	97(51.3%)	64(51.6%)	161(51.4%)	
Knowledge about dental stem cells banking.	No	100(52.9%)	59(47.3%)	159(50.8%)	0.356
	Yes	89(47.1%)	65(52.4%)	154(49.2%)	
Saving teeth and dental tissues for future regenerative dental treatment.	No	24(12.7%)	18(14.5%)	42(13.2%)	0.644
	Yes	165(87.3%)	106(85.5%)	271(86.6%)	

Pearson's Chi-Square test
**** Statistically significant***

DISCUSSION

Recent advances in identification and characterization of stem cells in the dental pulp of permanent and deciduous teeth has led to an increase in research activities at dental tissue engineering approaches, suggest that dental professionals as well as dental students at both undergraduate and postgraduate level should not only have comprehensive scientific knowledge obtained through curriculum and literature but also have awareness regarding the various aspects of dental stem cells [2,4]. In the present study we have included dental professionals and dental students. We have also categorized the study population into groups depending upon their clinical experience to study their response pattern.The present study revealed more than half of the study participants (69.3%) were aware of various applications of dental stem cells which was comparable to study by Chitroda et al., Jose and Sede et al. among dental professionals [1,2,5]. These observations can be due to increase in conducting more scientific awareness programs through forums including symposiums, conferences, Continued Dental Education Programs regarding stem cell therapies. In the present study only 42.5% of dental professionals does not believe any purpose in dental stem cell banking which is in contrast to previous studies by Jose [2] and Chitroda et al. [1] regarding awareness of dental stem cell banks. It may be because of our study population that involved dental practitioners and students at both undergraduate and post graduate level comparable to studies involving only postgraduates (postgraduate students and faculty members). About 45.5% of the participants considered stem cells can be used for regenerative dental treatment slightly lesser than study by Ez-Abadi et al [4] and chitroda et al [1] as this may be due to the fact many believe dental pulp stem cells have similar potential to differentiate when compared with the bone marrow stem cells.The main source of information on dental stem cells was journals (33.5%) in the current study where as the major source of information was internet followed by books in study by Chitroda et al. [1], Nagraj et al. [7] and conference/symposium/seminar in study by Sede et al. [5] This could be due to increased publications, accessibility and availability of scientific literature, general influence of conversation regarding the stem cell in dentistry. It was also observed that 50.5% of dental professionals have attended several training courses on dental applications of stem cells and nearly half of the participants have attended seminars on stem cells. Since dental stem cells are not taught as a part of curriculum, this may be the outcome of the interest shown by the professionals as well as students to attend more such scientific events like CDE programs, conferences, symposiums and seminars related to dental stem cells.Almost 63.8% of participants were aware of the term stem cells in dentistry and nearly half of the participants were familiar with the source of dental stem cells where as 54.8% were knowledge about the sources of dental stem cells according to study by Alomar et al. [8] and 93.6% in study by Jose et al. [3]. This may be because of less information and knowledge obtained about stem cells that were taught during under graduation. On evaluating the knowledge regarding the important role of stem cells in tooth reconstruction demonstrated that the majority have an idea about the optimum root length of the tooth to harvest the stem cells after extraction. Almost 41.9% felt that the procedure taken in dental stem cells is continued root formation and regeneration of enamel while very few are unsure about it. Hence, there is a need to create adequate knowledge and spread awareness regarding the procedure and treatment guidelines using dental stem cells. Apart from these several other factors such as high cost, ethical issues on using stem cells among dental practitioners also needed to be considered.

Limitations

The study participants were selected using a non-probabilistic convenient sampling method due to practical difficulties, thus preventing the generalization of our findings. We collected data only from dental students and dental professionals however other health care professionals, research scholars were not taken into considerations, although it is beyond the scope of the current study, we consider it as a potential limitation. Another important limitation of the study is the non-availability of extensive data regarding the potential utilization of dental stem cells in India owing to several risk factors and obstacles such as cost, skills, training, and ethical issues to seek dental treatment.

CONCLUSION

This enforces a need to create and spread more awareness sessions on several clinical advances and applications, stem cell banking, and procedural or treatment guidelines related to dental stem cells among dental professionals irrespective of their experience and academic qualifications by conducting scientific events such as seminars and also by organizing conferences and

increasing the number of research projects. Similar surveys and research must be carried out at different levels and ethical codes needed to be updated. Nevertheless, it is necessary that both clinicians and patients should be provided with information regarding several new treatment modalities available such as dental stem cell therapies.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-44

Esthetic Management *of* Congenitally Missing Teeth

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Abstract: With the advancement of new technologies and biomaterials, the need for aesthetic restorations have resulted in augmented utilization of dental ceramics for restoring anterior and posterior teeth. Due to the short comings of traditional dental ceramics, newer materials have been introduced. Zirconia is one such material. Tooth preparation for all ceramic restoration is more conservative than porcelain fused to metal preparation as space for metal is an important requirement. All ceramics crowns are aesthetically better than porcelain fused crowns to metal because of its opaque property. This article describes a case of anterior aesthetic rehabilitation with zirconia crowns after orthodontic treatment of a patient with congenitally missing maxillary bilateral lateral incisors.

Key words: Zircon, dental ceramics, orthodontic, zirconia.

INTRODUCTION

Zircon is one of the gem from ancient times [1]. The name, zirconium, is derived from the Arabic Zargon (golden in colour) which is adapted from Persian words such as Zar (Gold) and Gun (Colour). Zirconia was first identified by Martin Heinrich Klaproth in 1789.The metal oxide Zirconia, (ZrO2) is formed as a product after heating various gems which was then incorporated with rare earth element as pigments. Zirconia shows excellent biocompactability, reduced plaque retention than titanium, good radiopacity, resistant to corrosion. Nowadays, various research revealed that zirconia due to its highest strength, it is used as a aesthetically optimal, biocompatible material indicated for restoration of anterior and posterior teeth. The CAD-CAM method used for its fabrication ensures accurate marginal fit and satisfies the aesthetic need of the patient. Zirconia is one of the most predominantly used biomaterial in the field of dentistry and dental implantology [2]. Due to its excellent mechanical properties, it is considered to be a superior metal free restoration with good aesthetic outcome.

Case Report

A female patient named Miss.Madumitha of age 16 reported to the dental OP with the chief complaint of spacing in the anterior maxillary region. On intraoral examination, there was missing teeth in relation to 12 ,22,31,41[Fig 1 & 2].At this moment, patient was in the last stage of orthodontic treatment and as an interdisciplinary approach, orthodontic brackets were debonded and proceeded with prosthodontics treatment. Considering the age of the patient, treatment plan was made and was advised for an aesthetic all ceramic restoration such as zirconia.

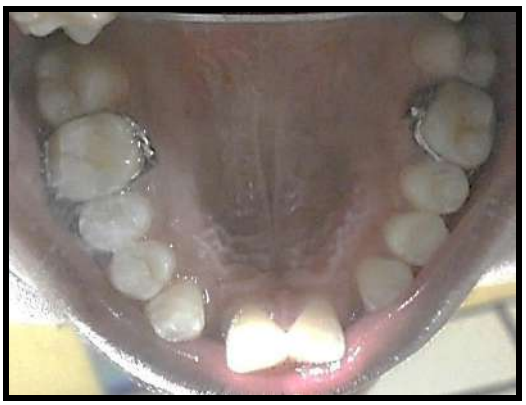

Figure 1 -Preop-Intraoral palatal view

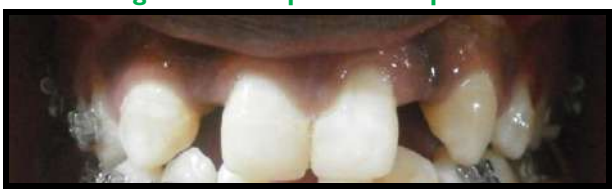

Figure 2 -Preop-Intraoral labial view

After clinical examination, initial alginate diagnostic impressions were made. All ceramic preparation was planned in relation to 11,21,13,23. All ceramic preparation was considered as one of the conservative preparation than porcelain fused metal as it does not require any space for metal. Opaque property and high strength of zirconia makes it an ideal material for aesthetic restoration. Shade selection (Vitapan 3D Master) was done before commencing the preparation facilitating anterior esthetics.

Diamond cutting burs were used for the preparation. Adjacent tooth contact was broken with tapered fissured diamond burs. Then the tooth preparation was done on the facial, lingual ,mesial and distal surface with straight fissure and inverted cone bur. Bevel shoulder preparation was done on mesial, lingual, distal, labial which enhance the marginal integrity of the restoration [Fig-3].The line angles and point angles are rounded and the taper of the preparation should be around 5 to 15 degrees. Occlusal clearance of 1.5 to 2mm is given in the incisal edges which is verified by using modelling wax sheet [3,4]. Gingival retraction cord is placed for proper replication of marginal preparation. Two stage putty wash impression was made and poured with Type IV gypsum material. Die was scanned and laboratory procedures were carried out.

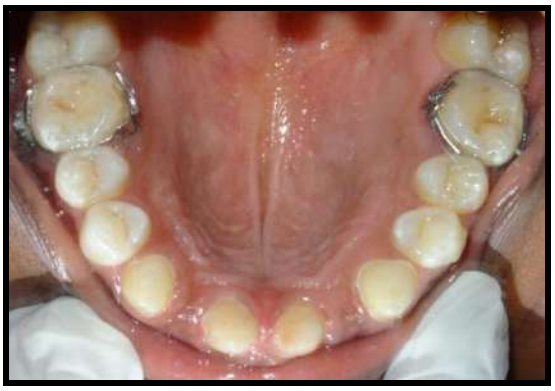

Figure 3-Prepared tooth in relation to 11,21,13,23

Temporization of the prepared tooth was done in relation to 11,21,13,23 using auto polymerized resin (Protemp). Zirconia crowns were manufactured in the CADCAM machine using the installed software followed by milling of the crowns [Fig 4& 5]. An aesthetic try in was made before final staining and glazing which also facilitates the clinician to understand the crown contour and colour. Contact points and occlusion were also verified and corrected at this stage. The tooth shade must be in harmony with remaining dentition for better aesthetics.

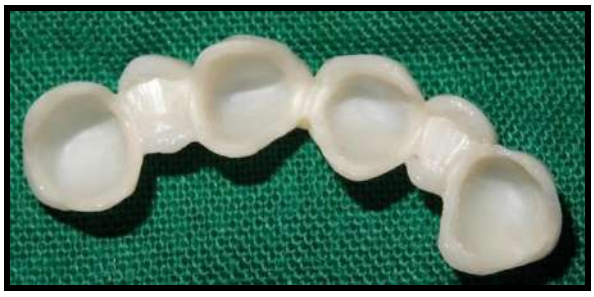

Figure 4 -Finished zirconia restoration

Figure 5- Final restoration in lab model

Before cementation, temporary restoration is removed, the excess temporary cement should be removed to enable a clean tooth surface. Zirconia crowns are usually cemented with dual cure resin bonded cement [fig 6 & 7]. The other cements which can be used are resin bonded glass ionomer cement and zinc phosphate. First the crown is etched with hydrofluoric acid followed by silane coupling agent and then air drying. Excess cement was removed with scalpel and all exposed margins were finished. Finished restoration was evaluated clinically and radiographically .

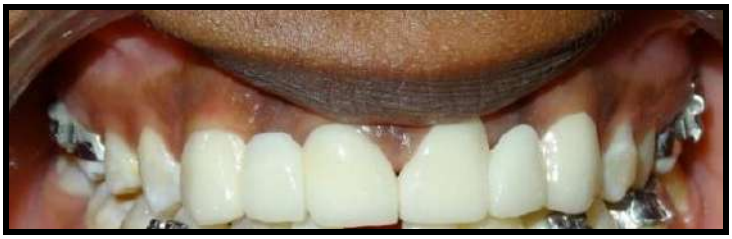

Figure 6-Cemented final zirconia restoration

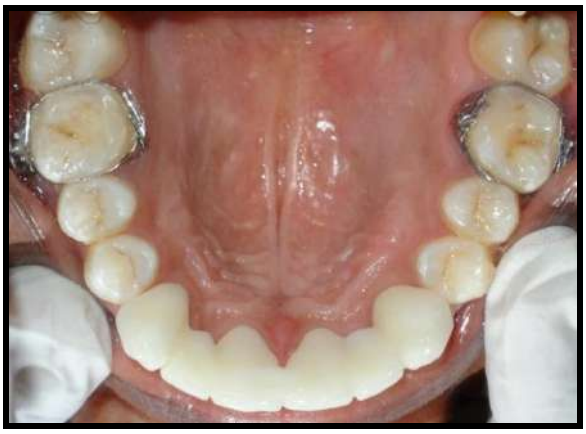

Figure 7-Finished zirconia restoration (palatal view)

DISCUSSION

Ceramics are translucent opaque material which offers good aesthetic result and provides sufficient biocompactability and long term stability of restoration. With incorporation of CAD-CAM system with improved esthetics ,partially stabilized zirconia have been used .Zirconia single restoration showed a success rate of 93% due to its high flexural strength of 500-1200 MPa and elastic modulus of 210 GPa To get an aesthetically pleasing restoration , the restoration should mimic the natural tooth in terms of contour, dimension ,texture and also in terms of translucency in order to achieve life like appearance. The translucency of the ceramic system depends on important factor that plays an role in light behaviour and in aesthetics [11] and also depend on light scattering color of tooth abutment. Milky white tooth color of the restoration can be avoided by two methods .One method is by applying a layer of stain or liner and second method is by painting the crown with colouring agent(solution) in the presintered state. Zirconia block which are available in pre-shaded form can also be used which requires firing only after machining which is more advantageous. With respect to abrasiveness and wear, zirconia crowns shows favourable properties. After finishing and polishing monolithic zirconia exhibits lowest wear towards opposing teeth. When polished, these materials exhibit tribiologic behaviour in terms of friction, wear and abrasiveness.[5,6,7,8] Zinc phosphate has a compressive strength of 104 MPa, whereas for glass ionomer it ranges from 53-96 MPa and for dual cure resin cement it ranges from 52-224 MPa. Due to the high compressive strength of dual cure resin than GIC and zinc phosphate cement, dual cure resin bonded cement is the first line of luting cements for zirconia crowns. Micromechanical interlocking between ceramic and resin cement According to various studies marginal fit of the zirconia restoration is better than internal fit and within the clinical acceptable value by American Dental Association. With regards to preparation geometry, the high stability and structural resistance of zirconia are compatible with both vertical and horizontal finish lines[9,10] .Certain studies showed the marginal gap values between 0 and 75 mm for Single crowns and 140 mm for Fixed partial dentures [11,12], showing an increasing proportional to framework span [13].

CONCLUSION

Successful treatment outcome in prosthetic dentistry is combination of aesthetics, phonetics, mastication which promotes self motivation to the patient psychologically and emotionally. This case being dealt as interdisciplinary approach satisfied the requirement of patient aesthetically and psychologically which further enhances the social well being of the patient.

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SP-45

Prosthodontic Approach For Management Of Flabby Ridges: A Review

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Abstract: "Flabby" or "fibrous" ridges are the alveolar ridges covered with mobile soft tissue. These tissues interfere with the retention, stability and support of a denture. Unless appropriately managed, flabby ridges may pose a problem to the prosthodontist and the patient. Dentures fabricated over flabby tissues have a tendency to become loose due to tissue rebound. There are several techniques suggested to overcome this difficulty like altered techniques for making an impression or using implant retained prosthesis or by removing the flabby tissues surgically. Non-surgical prosthetic management of flabby tissues includes special impression techniques and using a liquid-supported denture. This article reviews the different impression techniques which can be used for making an impression for flabby ridges which will provide better retention, stability and support of the dentures.

INTRODUCTION

A final impression made for a complete denture needs to 'record the entire functional denture bearing area" to provide good retention, stability and support for the denture while in use.[1] However, problems emerge when the quality of the denture bearing area is insufficient for this purpose. Displaceable ridges, often known as "flabby ridges," pose a number of challenges and might lead to complaints of discomfort or looseness when a full denture is seated.[1] According to published research, flabby ridges can be found in up to 24% of edentulous maxillae and 5% of edentulous mandibles.[1] The 'Combination Syndrome,' as defined by Kelly in 1972, causes a flabby ridge to develop on the maxillary anterior area and includes resorption of alveolar bone in the anterior maxilla, enlargement of the maxillary tuberosity and resorption of bone underneath the mandibular denture bases.[2,3,5] When there is a longstanding edentulous zone opposing normal dentition, it may be present on other denture-bearing regions as well.[2] Surgical, non-surgical techniques and implant retained prosthetic treatment can be used to manage a flabby ridge.[2,4] Impression methods are used in the non-surgical procedure to record the flabby tissue in an undisplaced or static condition and the denture-bearing tissues to be recorded in a compressed state for adequate support.[2] Chase was the first to use elastic impression material to alleviate traumatised tissue in 1961.[6] However, this may only be a temporary solution.[6] Furthermore, this may promote candidal growth.[6] An ideal denture should be able to endure masticatory pressures and have a flexible tissue surface to avoid stress concentration and damage on the underlying tissues in a flabby ridge state.[6] As a result, a liquid-supported denture may be a viable solution to this issue.[6]

Four broad concepts for impressions have been described:[5]

1. "The mucostatic technique"
2. "The muco -compressive technique"
3. "The selective pressure impression technique in which some denture bearing tissues are displaced and others are not"
4. "Functional impressions"

This article describes the management of flabby tissues using the non-surgical procedure i.e. the modified impression techniques and by using liquid supported dentures.

IMPRESSION TECHNIQUES

1) Jone D Walter Technique[7]

In this approach, zinc oxide eugenol paste is used to record the healthy denture bearing tissues and impression plaster is used to record the displaceable tissues[7,8,9]

2) Allan Mack's Splint Method[7]

When the tissues are excessively flabby, this technique is employed. In this method, trays with a lot of relief over the fibrous tissue or trays that are loosely fitting are used.[7,8,9] First, the flabby region is painted with plaster of around 3 mm thickness, then the plaster is allowed to set.[7,8,9]

After that, the tray is filled with the second mix of plaster and the imprint is taken.[7,8,9] As a result, the first plaster covering of flabby regions functions as a'splint,' which is later removed with the second mix of plaster impression.[7,8,9]

3) Fluid Wax Impression[7]

It records the primary and secondary stress bearing regions by utilizing molten wax.[7] It does not alter the tissues of residual ridge.[7] It is a functional impression method.[7]

The techniques are

a) Hobkirk Technique[7]

Also known as One Part Impression Technique.[7] After proper border correction, preliminary impressions are made with low-viscosity alginate impression material using stock trays.[7] Primary cast is poured and over that a spacer of adequate thickness is adapted and special tray is fabricated.[7] Holes are made on the trays over the flabby areas to decrease the pressure.[7] Another impression is made with low viscosity impression materials like alginate, low-viscosity silicone or impression plaster.[7]

b) Window Technique[7]

Watson described the window method. An aperture termed a "window" is created on the custom tray over the flabby region in this procedure. On the custom tray, zinc oxide and eugenol are utilised to make a mucocompressive impression. After the impression sets, it is removed. It is trimmed and re-seated in its original position. Through the window, a thin mixture of 'plaster of Paris' is applied to the flabby region. After the plaster sets, the impression is removed from the mouth.[7, 10,11,12]

c) Two Part Impression Technique: Mucostatic and Mucocompressive Combination.[7]

Excessive pressure areas or tissue blanching can be detected using a transparent processed acrylic resin tray. The tray has a little handle on it to make it easier to take it to the mouth. Stability, retention, and muscular interference are all evaluated on the tray. The blanching zone is indicated on the tray, and the appropriate sections are removed with a bur until all tissue blanching is gone. On the tray, 5 mm apart on the anterior flange from canine to canine, holes are drilled. From the premolar to the molar area, finger rests are formed bilaterally. Putty silicone material is used for border molding and light body silicone impression is used to make the impression.[7, 13]

d) Controlled Lateral Pressure Technique[7]

In a fibrous posterior mandibular ridge, this method is used. A properly extended custom tray is used with Greenstick tracing compound, which is utilised for border moulding and recording the denture bearing area. A heated device is used to remove the excess green stick from the fibrous crestal tissue, and vent holes are created in the tray in this area. After that, a light body silicone impression material is used to make an impression on the buccal and lingual sides of the green stick in the region. Excess material flows out via the vent holes.[7,14]

e) Spacer Guided Differential Pressure Technique[7]

This approach prevents overloading the ridge's crest and allows for cautious ridge height preservation for stability. In the anterior zone, 2 mm of wax spacer was adapted, and in the "flabby" region, 3 mm of wax spacer was adapted. Differential pressure generated by changing the thickness of the wax spacer, wax spacer removed after border moulding and relief vents constructed in the flabby zone, low viscosity polyvinyl siloxane used for final impression.[7,12]

CONCLUSION

The prosthodontic rehabilitation of fully edentulous individuals is complicated by flabby or fibrous tissue and achieving a stable and retentive complete denture prosthesis is a difficult task.[2,15] In such situations, surgical excision and dental implant treatments are options, but they may not be viable for those individuals due to medical sickness or treatment costs.[15] So, to attain the desired results, nonsurgical treatment of these ridges should be prioritised, followed by modified prosthodontic procedures.[2] Dentures that are made using traditional impression procedures to record such flabby tissues are frequently unretentive and unstable.[15] Flabby ridges can be efficiently corrected without any further trips to the clinic by using certain adjustments to current impression procedures and newly developed materials with enhanced physical and handling qualities.[15] The limitations should be addressed with the use of selective pressure or minimally displacive impression methods.[2] In dental clinics, the materials utilised are easily available. In primary health care centres, even regular dentists may handle such instances.[15]

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-46

Soft Tissue Lesions In Complete Denture Wearers- A Review

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Abstract: Complete edentulism is mostly seen in the elderly population and it can be treated using removable or fixed prostheses. Edentulous patients should undergo prosthetic rehabilitation to prevent complications arising due to edentulism. Complete denture is one of the most commonly worn dental prosthesis amongst the elderly population. With long term use of dentures, complete denture wearers experience a number of soft tissue lesions such as inflammatory lesions, hyperplasia, mechanical irritations, white lesions and ulcerative lesions. Significant alterations in the oral environment and the oral mucosa are noticed following denture insertion which may compromise the oral tissues' integrity.[1] Mucosal alterations can be caused by microbial plaque buildup, mechanical discomfort from dentures, fungal infection, a toxic or allergic reaction to denture components or traumatic occlusion.[1] This article reviews the soft tissue lesions which is usually experienced by complete denture wearers and about the prevention and management of the same.

INTRODUCTION

The oral mucosal lesions caused by removable dentures might be acute or chronic responses to microbiological denture plaque, an injury due to mechanical forces by the dentures or a reaction to denture base material components.[2] Traumatic ulcers, allergic responses to denture materials, and acute infections are all examples of acute reactions.[2] Denture stomatitis induced by chronic infection or trauma, flabby ridges, denture irritation hyperplasia, angular cheilitis and oral carcinomas are among the chronic responses.[2] The most common responses are chronic ones.[2] Angular cheilitis can be caused by a variety of factors and is not always linked to the presence of dentures.[2] Only a small percentage of oral carcinomatous lesions may be linked to the use of dentures.[2] Due to changes in the oral cavity's environmental parameters and loading of the oral mucosa, dentures may be the direct cause of these diseases.[2] It is important for the dentist to have enough medical knowledge and to do suitable clinical and laboratory exams in order to establish a good diagnosis and to implement appropriate therapy and prevention.[2] The goal of this study is to assess the etiological and diagnostic elements of these pathological conditions by reviewing the literature on clinical characteristics and histology.[2]

a) Inflammatory Lesions[3]

- Denture Stomatitis- Stomatitis is an inflammation of the oral mucosa.[1] Denture stomatitis or denture sore mouth or inflammatory papillary hyperplasia or chronic atrophic candidiasis is a medical word that refers to an inflammatory condition of the denture-bearing mucosa and occurs when a person wears dentures.[1,2] It's a typical issue among seniors who wear complete or partial dentures.[1,4] Erythema characterises these alterations, which can occur with full or partial dentures in both jaws, but are more common in the maxilla.[1,2] Occurrence affects 11-67 percent of full denture users, and it affects women more than males.[1,4] The palatal mucosa, which is covered by the denture base, is the most prevalent place for fungus to thrive.[1,4] According to some studies, up to two-thirds or more of people who wear removable full dentures can develop denture stomatitis.[5-9] Denture stomatitis, despite its prevalence, is frequently asymptomatic; only a small percentage of sufferers report discomfort, burning sensations or itching and the condition is identified largely upon examination.[5] It often presents as inflammed or swelled mucosal tissues that are covered by the denture.[5]

Newton (1962) categorised it as follows based on its clinical appearance:[5]
"Type 1: A localized simple inflammation or pinpoint hyperemia."
"Type 2: An erythematous or generalized simple type seen as more diffuse erythema involving a part or the entire denturecovered mucosa."
"Type 3: A granular type (inflammatory papillary hyperplasia) commonly involving the central part of the hard palate and the alveolar ridges."

Denture stomatitis' pathogenesis is still debated due to its complex character.[5] Denture hygiene, denture use at night, denture injury due to ill-fitting dentures or incorrect vertical dimensions, Candida infections, systemic conditions like diabetes and other immuno-compromised states and dietary factors like folate, Vitamin B_{12} deficiency are all the factors to be considered and have been postulated as predisposing conditions for denture stomatitis.[5] A successful treatment plan for such patients should include:[3] (1) a procedure to restore abused tissues to good health injured by existing dentures; (2) precise impressions made using no pressure technique; (3) recording accurate jaw relation; (4) no occlusal interferences; (5) proper oral hygiene maintenance; (6) correction of the deleterious habits of patients in any; (7) Dentures should be removed from the mouth for 8 hours each day to allow the tissues to relax.[3]

- Stomatitis Venenata- Some people respond to medicines and materials differently than others. Stomatitis venenata refers to reactions in the mouth to medicines and materials used.[3] Initial redness, discomfort, swelling, bullae and vesicles are all possible clinical signs.[3] Some dentists have been worried since the introduction of methyl methacrylate for dentures about the possibility of denture users being sensitised to the substance.[3] Many denture users have been diagnosed with stomatitis

venenata, which causes redness, burning, discomfort and an odd taste in the saliva that are restricted to the tissues covered by the denture bases.[3] Although some people who deal with methyl methacrylate might have severe allergic skin responses, the majority of patients who are diagnosed with stomatitis venenata really have chronic denture stomatitis.[3]The denture base material has no bearing on the oral responses.[3] The clinical fact that replicating the denture in a different material does not cure the symptoms supports this viewpoint.[3] Under vulcanite dentures, the symptoms were occasionally noticed and free sulphur was considered as the reason.[3] Fisher has demonstrated the ineffectiveness of the so-called patch test, which involves pressing a denture or a sample of the base material against the skin.[3] He also documented individuals who had a high positive reaction to methyl methacrylate monomer during patch testing but had no mouth complaints while wearing acrylic resin dentures.[3]

a) Hyperplasias[3]

- Fibrous Hyperplasia or "Flabby" Ridges[3] - Under the denture foundation, there are rolls of hyperplastic tissue.[3] These tissues do not provide proper retention, stability and support to the dentures which leads to loosening of the dentures.[10] The lesion is painless and develops slowly, so the patient may not be aware of its presence.[3] The most common location is at the front of the maxillary ridge.[3] Flabby ridges can be present in up to 24 percent of edentulous maxillae and 5% of edentulous mandibles, according to published studies.[10] The 'Combination Syndrome,' as characterised by Kelly in 1972, causes resorption of alveolar bone in the anterior maxilla, expansion of the maxillary tuberosity, and loss of bone beneath the mandibular denture bases, resulting in a flabby ridge on the maxillary anterior region.[10-13] It appears to be produced by both bone resorption and pressure at times, with the lesion filling the gap beneath the denture base created by bone loss.[3] The mass might be as thin as 1 mm or as thick as 6 mm in thickness.[3] This is generally produced when a single maxillary complete denture is opposed by natural lower anterior teeth.[3] This is also seen in cases of increased overbite in the dentures.[3] A flabby ridge can be treated with surgical, non-surgical, and implant-retained prosthetic therapy.[11,14] In a non-surgical technique, impression methods are utilised to record flabby tissue in an undisplaced or static state, and denture-bearing tissues in a compressed state for appropriate support.[11]

- Papillary Hyperplasia- This is mostly found in the palate.[3] It presents clinically as a warty appearance on the affected area as it is made up of several closely spaced papillary projections.[3] The length and diameter of the papillae are generally between 1 and 2 mm.[3] There may or may not be any inflammation.[3] Improperly fitted dentures, wearing dentures 24 hours a day and poor oral hygiene are all etiological factors.[3] This is an irreversible condition.[3] The problem may be avoided, however, if patients avoid wearing their dentures all of the time and leave them out for short periods of time, especially at night, and maintain appropriate denture hygiene by washing them with soap, brush and water.[15,16] Dentures should be cleaned on a regular basis using denture cleaners such as 2% chlorhexidine gluconate or 2% sodium hypochlorite or alkaline peroxide solutions.[15,16] Antifungal medication, oral rinses and gels, or conservative surgery can all be used to treat a small localised lesion.[15,17] The administration mechanism, whether systemic (like Fluconazole) or local (like Amphotericin B, 2% miconazole gel) can be effective.[15,17] However, when the lesion is aggressive and significant papillary development is evident, the surgical method is employed.[15,18] Cryotherapy, resesctive surgery, Supraperiosteal excision, electrosurgery, mucoabrasion, fullguration, blade-loop surgery or laser surgery are some of the procedures available.[15,18] In the treatment of severe types of IPH, surgery is still the gold standard.[15,18] Use of razor-moved blade cutting and Electrosurgery are the two typical surgical treatments.[15]

b) Ulcerative Lesions

- Angular Chelitis- Lesions are seen bilaterally on the angles of the lips in complete denture wearers.[3] There may be deep fissures or cracks that seem ulcerated, and may have an exudative crust.[3] Almost without exception, such patients' dentures do not provide enough vertical occlusion dimension.[3] A fold forms at the corners of the mouth when such dentures are in occlusion.[3] In these regions, saliva and food waste accumulate, forming cracks that become infected with different organisms.[3] Patients frequently grow a habit of licking their lips and the lesion.[3] As a result, the word "perleche," which means "to lick over," is alternatively employed.[3]

It can be treated by improving the vertical facial height, by applying nystatin, amphotericin B, ketoconazole, mupirocin, fusidic acid and miconazole nitrate topically, cessation of habits, elimination of allergens.[19]

CONCLUSION

Despite being a foreign body, the complete dentures are well accepted and tolerated by the tissues in the oral cavity to a surprising degree.[3] As prosthodontists, we may take comfort in the knowledge that the incidence of oral cancer caused by dentures is exceedingly rare.[3] At the same time, we must remember Sheppard and companions' statement: "Complete dentures are not the harmless gadgets we frequently believe they are."[3] Every dentist must keep in mind that one of his most important responsibilities is to be able to detect cancers.[3]

There are several ill-effects of denture wearing on the hard and soft tissues but the patient should be treated for edentulism and the dentist must focus on reducing the ill-effects caused due to wearing dentures.[3] To reduce the ill-effects of the denture on the tissues, the following measures can be taken:[3]

1. A thorough and proper examination should be done in the first diagnostic appointment;
2. Condition of all the tissues and the effect of dentures on them and the systemic condition should be comprehended;
3. There should be a rest period of at least 8 hours to enable the tissues to regenerate;
4. The patient should be called for routine examination.[3]

CONFLICT OF INTEREST

Conflict of interest declared none.

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SP-47

Role Of Prosthodontist In Forensic Odontology – A Review Article

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Abstract: Forensic odontology has recently become an integral part of forensic science. Any term associated with a court of jurisdiction is referred to as forensic. Forensic medicine is concerned with the application of concepts by practitioners of medical and paramedical sciences in the administration of justice. It includes various disciplines such as forensic toxicology, forensic engineering, forensic anthropology, and forensic odontology. Various odontological characteristics, such as DNA fingerprinting, bite mark identification, rugoscopy, and cheiloscopy, are used in forensic dentistry; however these markers are of little help in patients who are entirely edentulous. Due to infrequent follow-up of edentulous patients and a lack of record keeping by dental practitioners, dental records of edentulous patients are frequently limited. As a result, providing some type of permanent denture labeling or marking could be a solution to these issues. This paper presents a review of available literature emphasizing the fact that how a Prosthodontist can play an important role in identification of a deceased individual if trained to do so.

Key words: Forensic odontology, Prosthodontist, Forensic dentistry, edentulous patient.

INTRODUCTION

Forensic dentistry is primarily concerned with the cranio-facial structures. The teeth and their dental restorations, dental prosthesis, pattern of bone trabeculae, arrangement of air sinus, and overall oro-facial morphology present a wide number of choices and information[1]. According to "KeiserNielson," forensic odontology is the area of dentistry that deals with the proper management, analysis, and evaluation of dental evidence in the interest of the court system[2]. It includes various odontological parameters such as DNA fingerprinting, bite mark identifification, rugoscopy and cheiloscopy. The major function of this specialized field is the identification of unidentified bodies involved in any criminal case, natural disaster, or other catastrophic occurrence[3]. As a result, any dentist has a moral, social, and legal obligation to keep antemortem records of their patients in order to serve as a helpful identifying tool in the event of a tragedy or disaster[4]. The identification of shattered, burnt, or degraded bodies presents a considerable challenge in the investigation. The loss of finger prints, facial features, and, in certain circumstances, the lack or mutilation of body parts, is a fundamental constraint in identifying these non-viewable types of human remains[5]. Teeth are said to be the most durable structure in the human body. Teeth and the human dentition are distinctive and individualistic due to a variety of internal and external factors. All of these features combine to make the human dentition an excellent source of post-mortem data, particularly for non-visible human remains[6]. In addition to these existing odontological parameters, the prosthodontist can provide accurate and definitive identification markers by including various identification aids in the prostheses delivered to the patient and maintaining a database for the same, which can aid in positive identification of individuals by matching antemortem and postmortem data[4].

REASONS FOR IDENTIFICATION[7]

Identification of deceased individuals helps in various ways as

1. Criminal — in most cases, a criminal death enquiry cannot commence until the victim has been positively identified.
2. Marriage - People of various religious backgrounds are unable to remarry unless their previous partners have been proved dead.
3. Monetary (Financial) - Payment of pensions, life insurance, and other benefits is contingent on positive death confirmation.
4. Burial - Before being buried in a geographic location, many religions need a confirmed identification.
5. Social - It is the responsibility of society to protect human rights and dignity after death, which begins with the fundamental basis of identification.
6. Relieve (closure) - The identification of people who have been missing for a long time might bring a sense of relief to family members.

HISTORY [1, 9, 10, 11, 12, 13]:

There was historical evidence of persons being identified based on the evaluation of prosthodontic appliances:

- A young dentist named Paul Revere detected battle casualties by bridgework during the American Revolutionary War in 1775.
- A gold denture assisted in the identification of Countess of Salisbury's charred remains in 1835.
- Denture wearers made up 819 of the 3000 unidentifiable dead troops after Second World War. Unfortunately, only nine people who wore dentures were identified.

- Dr. J W Webster assassinated Dr. Goerge Parkman, a Harvard University professor, in November 1849. Dr. N C Keep, who had made a removable partial denture for Dr. Parkman, had utilised a burned fragment of a tooth fused to gold to identify the body.
- A horribly mangled body discovered on the railway line at Mt. Kuringai in Sydney in April 1968 was recognised by an upper acrylic denture with a name engraved on it.
- Gold inlays, crowns, bridgework, and dental implants are used to identify European tourists who died in the tsunami.
- In 1977, the bodies of Adolf Hitler and his wife were identified using dental records, with the help of radiography and prosthesis.
- Many others, such as M. Raja Jayachandra Rathore of Canouj, who died in combat in 1191, were identified by his artificial front teeth. This was most likely India's first case of dentition-based identification.

DENTAL IDENTIFICATION [14, 15]:

A Prosthodontist can play a critical part in forensic identification by utilising numerous procedures and techniques available in the literature. For identification, many processes and techniques are used, and a Prosthodontist can become a member of this team and provide these services more effectively.

The role of Prosthodontist in Forensic odontology is:

- a thorough understanding of dental materials
- the ability to engrave records into prostheses
- the study of rugae patterns
- bite mark impressions
- lip print recording and identification

CENTRAL DOGMA OF DENTAL IDENTIFICATION [8]:

There are two main steps to dental identification:

- First, to demonstrate a high degree of certainty, comparison identification between the remains of a deceased and a person represented by antemortem (before death) is done. In most cases, the body or circumstantial evidence provides information that aids in the identification of the deceased person.
- Second, in circumstances when there are no antemortem records and no other clues to the person's identification, the forensic dentist creates a postmortem (after death) dental profile that suggests features of the person and aids in the search for antemortem materials.

INTELLIGENT DENTAL IDENTIFICATION SYSTEM [16]:

- Design and development of dental records, dental databases, and identification models are all included.
- From the ability to analyse data structure, Intelligent Dental Identifying System (IDIS) can incorporate all important dental data for identification purposes.

DNA IDENTIFICATION [17, 18, 19]:

- Each person's DNA pattern is distinct. Teeth are a valuable source of DNA material due to their resistance to external stress such as incineration, immersion, mutilation, and decomposition.
- When traditional dental identification methods fail, this DNA biological material can offer the necessary link to prove a victim's identity. This technique of identification should always be used as a supplementary method.
- Teeth, bone tissue, hair bulb, biopsy sample, saliva, blood, and other bodily tissues are the biological components that can be used to isolate DNA and perform laboratory testing for human identification.

PHOTOGRAPHIC SUPERIMPOSITION [20]:

- It is more difficult to determine whether a denture left at the crime scene belongs to an unknown set of skeletal remains.
- It is difficult to prove the identity of a complete denture and a skull since the morphological properties of the denture base, including the artificial teeth arrangement, must be compared to those of the surfaces of jawbones which cannot be observed from the outside.
- In such situations, Superimposition and X-ray computed tomography are efficient in providing proof of identity.

RUGOSCOPY [21, 22]:

- Palatoscopy is the study of the palate in general, and Rugoscopy is the study of the patterns of the grooves and ridges (rugae) of the palate in order to detect particular patterns.
- The palatal rugae were first described by Winslow in 1753 which are uneven, asymetrical mucous membrane ridges that stretch laterally from the incisive papillae located in the anterior half of the mid palatine raphe.
- The arrangement of these rugae is considered unique to each individual which retains its shape throughout life and can be utilised as a reliable strategy in postmortem circumstances.
- The rugae are highly protected from trauma and high temperatures since they are anatomically surrounded by cheeks, lips, tongue, buccal pad of fat, teeth, and alveolar bone.
- They can be utilised as a reliable reference landmark during forensic identification when antemortem data has been stored beforehand.
- Palatal rugae are an ideal forensic identifying parameter because of their uniqueness, post mortem resilience, overall stability, and low cost of use.
- A prosthodontist can identify the bearer of an upper denture by identifying the rugal pattern, and some judgments are frequently made using ante-mortem impressions taken for study models or prosthodontic consideration.

BITE MARK ANALYSIS [23, 24]:

- Bite mark identification is a science that can be used to connect a suspect to a crime.
- The mark created by human or animal teeth in the skin of alive humans, cadavers, or unanimated items with somewhat softer consistency is referred to as a bite.
- Bite marks are impressions left on food, skin, or other materials left at a crime scene, depending on the incident or circumstances. They may be found on the victim of an assault.
- Aside from identifying the agent, bite mark analysis in a forensic investigation can reveal the type of violence and the time between the development of the bite mark and the inspection.
- Bite mark interpretation necessitates a three-dimensional reconstruction.
- Prosthodontists are knowledgeable with the qualities of various impression materials used in various scenarios, and so can assist in the creation of an accurate duplicate.
- Bite marks have the following physical characteristics:

1. The distance between the cuspids.
2. Alignment of the teeth
3. Teeth width, thickness, and spacing
4. Teeth that are missing
5. Wear patterns.
6. Dental history, including fillings, crowns, and any restorations

SEX DETERMINATION THROUGH PULPAL TISSUE [24]:

- The sex determination from pulpal tissue is based on the presence or absence of X-chromosome

PROSTHESIS LABELLING [9, 25]:

Currently, two methods of denture marking are suggested in the literature:

1. Surface marking methods
2. Inclusion methods

SURFACE MARKING METHODS:

- This procedure involves writing a small piece of data or a code number on the denture; it does not physically alter the denture and preserves its structural integrity.
- As the prosthesis is used often and routinely, the written data or code fades with time, which is a major disadvantage of this technology.
- Surface marking on a denture can be accomplished in two ways:

a) scribing or engraving
b) embossing.

SCRIBING OR ENGRAVING:

- A small round bur is used to engrave short data or a code on the tissue fitting surface of maxillary dentures and the lingual aspect of the tissue fitting surface of mandibular dentures.
- To protect the structural integrity of the denture, the trough created by the bur should be as small as possible, and the patient should be informed on how to clean the dentures and maintain dental hygiene.

EMBOSSING

- A small bur is used to etch a short code or data into the master cast in this technique. The engraving on the maxilla is done on the palatal area, whereas the engraving on the mandible is done on the lingual aspect of the alveolar ridge.
- Following that, the usual stages of denture fabrication are followed, and the engraving is transferred as an elevation onto the intaglio surface of the denture.
- This practise is strongly prohibited since it irritates the underlying tissues and leads to the development of denture sores.

INCLUSION METHODS

- In this method, the short data or code is incorporated into the denture and it becomes the structural component of the denture. The structural integrity of the denture will be compromised if the inclusion is not done correctly and it will be unable to fulfil its core purpose which is the prosthetic rehabilitation.
- The following are the most prominent methods of inclusion:

1. ID bands
2. Paper strips
3. T bar
4. Laser etching
5. Electron microchips
6. Radio Frequency Identification (RFID) tags
7. Lenticular system
8. Denture bar coding
9. Photographs

1. **ID BANDS:**
- This process is used after the acrylic has completed its curing cycle but before the polishing and finishing steps.
- On a titanium foil or a Ho Matrix Band, a bar code or short data is inscribed. The denture is then etched with a shallow trough to accept the engraved metal band. The engraved band is firmly set in the trough, which is then filled and cured with clear acrylic. The conventional finishing stages are then carried out to prepare the denture for delivery.

2. **PAPER STRIPS:**
- In this procedure, the patient's information is typed on a piece of "Onion skin paper" and placed on the denture fitting surface, between the ridge and the middle of the palate. After that, it's covered in clear or pink acrylic before being sealed in the denture flask and cured, polished, and completed according to routine protocol.

3. **T BAR:**
- A "T" shaped clear acrylic polymethyl methacrylate resin bar with the patient's information or a short code is created. The denture base is created with a trough in the shape of the T-bar. After that, the T-bar is inserted into the trough, and clear acrylic is utilised to secure the structure to the denture base.

4. **LASER ETCHING:**
- This method is predominantly used for cast partial dentures; a copper vapour laser is utilized to etch the patient's specific details on to the metal. For a better view of the laser etched region, the piece carrying the short code or data can be overlay with clear acrylic.

5. **ELECTRON MICROCHIPS:**
- In this method, the patient's information or a code is etched onto a chip by the manufacturer. After that, the chip is inserted in acrylic resin. The chip's radiopaque property permits tissue-colored material to be placed over it. The chip can withstand temperatures of up to 600 degrees Celsius and is chemically resistant.
- The only disadvantage of this technology is the high initial cost, and the initial etching of features can only be done during the electron microchip manufacturing process.

6. **RADIO FREQUENCY IDENTIFICATION (RFID) TAGS:**
- An RFID system consists of a data carrier, also known as a transponder, and an electronic hand-held reader that uses an electro-magnetic field to energise the transponder. This hand-held reader can both write and read data to the tag.
- The large quantity of data that may be stored on the transponder is a major benefit of this approach. The RFID tags are also small (8.5 mm 2.2 mm) and can resist temperatures up to 1500 degrees Celsius.
- The main drawbacks are its high cost and lack of availability in most dental labs or dental offices.

7. **LENTICULAR SYSTEM:**
- In this method, a lenticular lens is used to create an image of the patient's face or any code. The images are printed on the back side of the synthetic paper and lenticular technology is used to laminate them on the lens.
- The main advantages of this technology are that it is simple, inexpensive, rapid, and weather resistant.

8. **DENTURE BAR CODING:**
- A bar code is a machine-readable code made up of a series of bars and spaces that are printed in predetermined ratios. The code is first printed on paper, and then photographed, and finally a negative is created. The negative is then transferred to silk. An industrial porcelain oven is used for this, which is heated to 860o C for 30 minutes. The coding from the negative is forced to transfer to the silk. This silk component can then be inserted into the denture and sealed with acrylic resin later.

9. **PHOTOGRAPHS:**
- This is a relatively new denture marking technique in which the patient's personal photograph is proposed to be incorporated into the transparent acrylic denture foundation.
- This strategy is effective in countries with a low literacy rate, when the simplest way of identifying is a photograph.

IDENTIFICATION OF DENTAL IMPLANTS [27, 28]:
- DNA, fingerprints, and dental comparisons are the most common scientific identifiers. In circumstances where the victim's fingerprint detail has been lost and the DNA has been denaturized due to cremation. Tooth loss will occur as a result of such extreme temperatures. Then, if any dental implants are found, they may be the sole evidence that can be used to identify the victim.
- Implants have a strong corrosion resistance, structural strength, and melting point, all of which contribute to keep implants intact after most physical assaults.
- Even when the implant was subjected to high heat exposure in a furnace, Berketa J et al. discovered that the batch number was still intact. The batch number was laser etched within the chamber of their implant and exposed to extreme heat in the experiment. When the abutment was removed, the result was an entire batch number that could be identified.

ABUSE [29, 30]:

- A dentist should be well aware of child, elderly or spousal abuse when any odd oral injuries, especially in cases of head or body injuries.
- Fragmented teeth, laceration of the labial or lingual frenum, missing or displaced teeth, maxillary and mandibular fractures, and bruised or scarred lips are all typical injuries in the face and mouth as a result of abuse. Abuse of the elderly is most widespread in both physical and psychological forms, especially in old age homes.
- Prosthodontists can aid to detect mistreated patients to a greater extent by carefully recording a complete case history and understanding their psyche, as they frequently deal with older patients.
- Prosthodontists should look for bruises behind the ear (battle's sign), traumatic alopecia (bald spots), any type of skull injury, retinal haemorrhage, blackened eye, any fracture in the face, lacerations, fractured tooth, avulsed or discoloured teeth in the absence of any reason to identify such patients.

CONCLUSION:

The use of forensic dentistry in the identification of a victim is no longer a novel idea. The oral cavity is a rich and noninvasive source of DNA that can be used to identify people and provide information for legal proceedings. However, dental practitioners must be encouraged to keep dental records and use distinctive markers in prosthetics, as well as maintain a database that can be accessed on demand. More research should be done to better identify population-based features in high-risk locations in order to further investigate this fascinating field of forensic sciences.

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SP-48

Special Purpose Removable Partial Dentures – Review Article

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Abstract: It is often observed in clinical practice that many patients present with varying conditions in the oral cavity. Variations could be anatomical, physiological, or connected to the specific patient's lifestyle. Regardless of the type of variation, it is critical that the prosthesis functions properly for each patient. When a traditional removable partial denture does not fulfil the demands of a patient owing to variances, various adjustments are performed to match the patient's needs. Unconventional removable partial dentures are the name given to such dentures (special purpose removable partial dentures). These unconventional dentures will help patients make treatment decisions based on the best possibilities available, as they provide a unique treatment plan for extremely unusual situations. Treatment options in conventional RPD are based on ideal scenarios, but unconventional RPD aids in the design of treatment modality for partially edentulous individuals when conventional treatment alternatives fail to meet the needs. A thorough knowledge about the special purpose removable partial dentures is essential to the success in the field of Prosthodontics. It should be approached in a methodical manner. This enables the dentists to make the best choice. This paper presents a review of available literature emphasizing the various unconventional partial dentures.

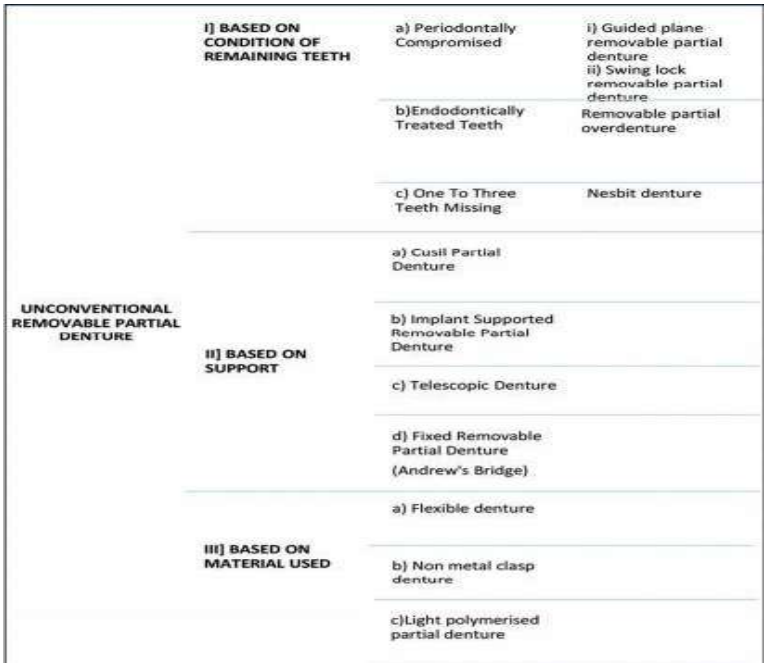
Key words: unconventional dentures, partial dentures, removable partial dentures, RPD.

INTRODUCTION[1]

The choice between the several treatment options for replacing missing teeth is impacted by clinical factor, dentist and patient. One of the most important needs for patients visiting clinics to restore aesthetics and/or function is the replacement of lost teeth. Removable partial dentures (RPD), fixed partial dentures (FPD), and dental implants are all options for replacing missing teeth. Each treatment method has its own set of benefits and drawbacks. Although partial dentures cannot be considered a replacement for artificial teeth, they have long been and continue to be the staple treatment for partially edentulous individuals. Conventional methods of denture fabrication cannot be used in the every case of partial edentulism. In case of compromised conditions, a minor change in the fabrication of the prosthesis is required to attain the optimum results. The increasing demand of the patients and the creative ideas of the Prosthodontist have resulted in the development of unique that is special purpose (unconventional) removable partial dentures. The unconventional partial dentures use novel approaches based on the same old Prosthodontia basics. These are a simple, effective, and non-invasive therapeutic option to the classical conventional procedure.

CLASSIFICATION OF UNCONVENTIONAL PARTIAL DENTURES[1]

it is critical to clinically identify partially edentulous individuals depending on removable treatment choices, unlike Kennedy and Applegate categories. The classification of unconventional RPD will aid in the selection of treatment alternatives. This classification will provide a distinct treatment scheme for extraordinarily rare circumstances, assisting in the development of treatment alternatives for partially edentulous patients when standard treatment options fail to meet the needs.



BASED ON THE CONDITION OF THE REMAINING TEETH:

PERIODONTALLY COMPROMISED

1. **GUIDE PLANE REMOVABLE PARTIAL DENTURE** [1, 2,3,4]:

- These are removable partial dentures with multiple proximal plates that slide on guide planes and clasps with rests, all of the weakening teeth are meticulously arranged.
- A removable partial denture with a guiding plane that is anchored on both sides of the arch and linked together with a rigid major connector (broad stress distribution) can give cross-arch stabilisation to buccolingual forces.
- The mobility of the teeth has stayed the same or decreased in all recorded cases when the guide plane removable partial denture has been worn.
- INDICATION - It aids in the stability of teeth that have been weakened by periodontal disease.
- DISADVANTAGE - Because several clasps and proximal plates of minor connectors (large metal display) are employed, the denture is not suitable in situations requiring cosmetic considerations (Kennedy's Class IV).

2. **SWING LOCK REMOVABLE PARTIAL DENTURE** [5, 6, 7, 8]:

- The swing lock denture was introduced by Dr.Joe J Simmons in 1963.
- The design was recommended for maximising stability and retention by getting access to many more tooth surfaces through the unique clasping mechanisms provided by the lock, hinge, and gate assembly, allowing all teeth to become primary abutments.
- In addition to the lingual major connector, this denture incorporates a labial bar (two major connectors). A hinge on one side and a lock on the other join the labial bar to the remaining elements of the denture, which extends labially all the way along the arch. During insertion, the labial bar can be unlocked and then locked.
- Swing lock dentures are so named because the labial bar moves around a hinge joint.

- **INDICATIONS**-

- Too few remaining natural teeth left to support a conventional removable partial denture.
- For conventional design, the remaining teeth are too mobile to serve as abutment teeth.
- In the lack of key abutments, fabricating a conventional removable partial denture is very impossible (primary abutments). The swing lock denture can be employed because it relies on the remaining teeth for support, retention, and stability. For example, when a canine is lost, a vulnerable lateral incisor serves as a terminal abutment.

- **CONTRAINDICATIONS**:

- Poor oral hygiene
- High frenal attachment
- Short lip or little vestibular depth
- Inadequate manual dexterity

I. **ENDODONTICALLY TREATED TEETH**:

1. **REMOVABLE PARTIAL OVERDENTURE** [9, 10, 11]:

- According to GPT 9, overdenture is a removable dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of natural teeth, and/or dental implants; a dental prosthesis that covers and is partially supported by natural teeth, natural tooth roots, and/or dental implants.

- **INDICATIONS**

- Patients with few remaining retainable teeth in an arch; patients with mal-related ridge cases; patients who require a single denture
- Patients with unfavourable tongue placements, muscular attachments, and a high palatal vault, which make the prosthesis unstable and difficult to retain.

- **CONTRAINDICATIONS**

- Patients with poor oral prophylaxis, systemic problems, and an insufficient inter-arch distance.

1. **ONE TO THREE TEETH MISSING**
2. **NESBIT DENTURE** [1]:

- Nesbit dentures are a type of conventional RPD that are used to replace one to three lost teeth on the same side of the upper or lower arch.
- The unique feature is that because there is no bilateral support from the other sides of the mouth to prevent destructive stresses from contacting the teeth supporting the Nesbit, it should be short term to avoid injuring adjacent teeth.
- INDICATIONS - Nesbit dentures are typically utilised as a temporary solution while patients wait for implant restoration.
- ADVANTAGES – No metal clasps, smaller and comfortable
- DISADVANTAGES – serious risk of aspiration and swallowing.

BASED ON THE SUPPORT

1. **CU – SIL DENTURES** [12, 13]:

- For individuals with few remaining natural teeth, several treatment alternatives are available, of which the Cu-sil denture, a newer type of transitional denture that serves as a therapy option for the preservation of few remaining natural teeth and hence the alveolar bone.
- Cu-sil dentures are one such friendly option that is both conservative and preventive in nature, since it aims to retain existing teeth while minimising alveolar ridge resorption.
- Cu-sil is the most basic and softest removable partial available. It's a tissue-bearing acrylic appliance with a soft elastomeric seal that clasps the neck of each natural tooth, sealing out food and fluids while cushioning and splinting each natural tooth from the hard acrylic denture base.
- By eliminating wear, stress, and torque, it helps to avoid tooth loss and improves the prognosis of loose, mobile, isolated, elongated, or periodontally involved abutments. This method of therapy does not necessitate any dental preparation or an additional patient visit.
- DISADVANTAGES – required frequent corrections, may lead to plaque accumulation.

3. **IMPLANT SUPPORTED REMOVABLE PARTIAL DENTURE** [14, 15, 16]:

- The distal rotation of the acrylic base at the free end region of RPDs distal to the last natural tooth is a difficult problem with conventional RPDs.
- A Kennedy Class I or II denture can be converted to a Kennedy Class III denture using distal implants.
- Fewer implants are required to produce a successful distal extension RPD while limiting alveolar ridge bone loss over time since the implant is placed in a distal position.
- Removable partial dentures supported by a combination of implants and the remaining teeth help to preserve soft tissue and hard tissue, boost patient satisfaction, reduce component wear and tear, helps to maintain bone loss within normal limits, and peri-implant soft tissue stable.
- INDICATIONS - lack of stability, decrease in function, reduced fibroelasticity of the peripheral soft tissue
- ADVANTAGES – cheaper (fewer implants needed), preserves bone quality and quantity.

4. **TELESCOPIC DENTURE** [1, 17, 18]:

- Although first described by Starr in 1886, telescopic copings were initially introduced as retainers for RPDs at the beginning of the 20th century.
- This arrangement of two crowns that can be fitted into each other became known as the telescopic denture because of its similarity to a collapsible optical telescope.
- Telescoping is when a primary full-coverage casting (coping/male telescopic portion) is luted to the prepared tooth and a secondary casting (superstructure/secondary crown/female telescopic portion) is a part of the denture framework and is retained by interfacial surface tension over the primary casting.
- They work by distributing forces along the abutment teeth's long axis and providing guiding, support, and protection from movement that might dislodge RPD's.
- ADVANTAGES – creation of common path of insertion, rigid splinting action

5. **FIXED RPD (ANDREW'S BRIDGE)** [19, 20, 21, 22]:

- Dr. James Andrews of Amite Louisiana (Institute of Cosmetic Dentistry, Amite, LA, USA) first introduced a fixed-removable prosthesis in 1965
- When all other conventional fixed or removable partial dentures failed to treat severe residual ridge resorption or jaw defect cases due to trauma and/or surgical ablation, Andrew's Bridge was developed to provide biomechanical stress distribution to improve or achieve comfort, hygiene, normal phonetics, and mostly normal aesthetics.

- Andrew's Bridge is a fixed retainer with removable pontics. The pontic assembly of a fixed removable partial denture is removed by the patient for preventive maintenance. The retainers are permanently fused to the abutments and are either porcelain fused to metal (PFM) or full veneer metal. The retainers are joined with prefabricated castable bars and then cast together, or a prefabricated metal bar is soldered to the metal copings after casting.
- Andrew's Bridge which has qualities of both the fixed partial denture and the removable partial denture can be indicated in cases where the abutments would support a fixed partial denture but a severe defect is present in the edentulous space.
- INDICATIONS – extensive supportive tissue loss and alveolar bone loss.

BASED ON THE MATERIAL USED

1. **FLEXIBLE DENTURE** [23, 24, 25]:

- When conventional dentures cause the patient distress, a flexible denture (soft denture) is typically employed.
- Flexible RPDs are basically advised in every partial edentulous situation as long as the patient is willing to use a removable prosthetic.
- Polyamide nylon is used in flexible dentures. Because flexible partial dentures rely on the ridge's undercuts for retention, it's recommended for ridges with bilateral undercuts.
- Patients with slanted teeth (due to a long period of missing adjacent teeth) develop an undercut, making hard partial dentures difficult to place. Flexible partial dentures are a superior alternative in certain situations.
- INDICATION - It is indicated in patients with acrylic monomer allergies because this material contains almost no free monomers; cases where clasps must be placed in the aesthetic zone, such as on the maxillary canine; and cases where financial constraints prevent the use of implants and the patient does not want FPDs.

2. **NON METAL CLASP DENTURE** [26, 27]:

- Metal clasps on the anterior teeth can cause aesthetic issues.
- Painting clasps with tooth-colored resin, using lingually positioned clasps, engaging mesial rather than distal undercuts, and using gingival approaching clasps are all options for overcoming this aesthetic challenge.
- An alternate denture clasp material is acetal (Bio Dentaplast, Bredent, Senden, Germany), a thermoplastic resin. In 1971, acetal was proposed as a non-breakable thermoplastic resin RPD material.
- MERITS – esthetically pleasing because of colour matching, in patients with metal allergy.

3. **LIGHT POLYMERIZED PARTIAL DENTURE** [28, 29, 30]:

- PMMA is also commonly used for interim restorations, denture repairs, and relines.
- Despite the fact that PMMA is an essential polymeric material in prosthodontics, a growing number of individuals are experiencing hypersensitivity reactions to it.Other polymeric materials that are non-allergic to the patient should be used for the denture base in such patient.
- Light-activated indirect composites, such as two urethane dimethacrylate (UDMA) composites, are potential alternatives to poly (methyl methacrylate) (PMMA), despite the fact that they contain multifunctional methacrylate monomers of 30 wt percent or more.
- When MMA monomer comes into contact with the skin or oral mucosa, it has been documented to trigger allergic reactions.
- MERITS - Denture bases made of polymerized UDMA are non-toxic and that the material that hasn't been polymerized appears to have toxicity is low. In addition, UDMA monomer is less allergenic compared to other acrylate series.

II. **MISCELLANEOUS**:

1. IMMEDIATE PARTIAL DENTURE [37, 38]**:**

- Immediate denture is dental prosthesis designed to replace damaged dentition and related structures of maxilla and mandible and inserted immediately following removal of remaining teeth.
- Immediate dentures can reduce alterations in the patient's appearance,that can occur when natural teeth are removed. Immediate dentures provide continual support, the tongue, lips, and cheeks will not change their positions and they allow patients to continue their social activities without being in an edentulous state.
- DEMERITS -Absence of stimulation provided by the natural teeth, involves a precise and time consuming protocol, anterior try for aesthetics is absent.

III. RECENT ADVANCES:

1. **CAD CAM PARTIAL DENTURES** [31, 32, 33, 34, 35, 36]:

- The RPD framework is made up of four parts: the base, plate, clasp, major, and minor connectors.
- Every aspect of the RPD framework must be well designed and given a high value during the design phase.
- Because of the wide variety of RPD pieces and their irregular shapes, designing a 3D RPD framework takes a long time and is difficult. For many years, researchers looked into the best CAD/CAM method and software for 3D designing of the RPD framework.
- Three steps make up the design process:

- scanning a definitive impression or pouring a cast from a definitive impression
- Using commercially available RPD computer aided design (CAD) software to export the scanned information for digital preparation and surveying of the cast.
- Creating a 3D printed RPD by incorporating all of the necessary framework components (minor and major connectors, guiding planes, rests, clasp assemblies, etc.).

- MERITS – reduced fabrication time and expenses, increased profitability and productivity of the laboratory.

CONCLUSION

The classification of unconventional partial denture facilitates uniform use of the system. It will help the Prosthodontist as well as Dentists assess patients for most appropriate treatment for better care. This article helps in reviewing cases of compromised and modified conditions where the unconventional RPDs can be used.

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ACUTE NECROTIZING ULCERATIVE GINGIVITIS-A REVIEW

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Abstract: Acute necrotizing ulcerative gingivitis (ANUG) is a non-communicable microbial gingivitis caused by a compromised host immune response. It is distinguished by the presence of "punched-out" crater-like lesions of the papillary gingiva, as well as the onset of sudden inflammation and pain.It is identified by necrosis of the gingival papillae crest, spontaneous bleeding, pain, and halitosis. If untreated, it can spread laterally and apically to involve the entire gingival complex, including the mucosa and alveolar bone, eventually leading to necrotizing ulcerative periodontitis, necrotizing ulcerative stomatitis, and Noma. Predisposing factors include poor oral hygiene, stress, smoking, hormonal imbalance, nutritional deficiencies, and so on.

Key Words: Punched out ulcer, Ulcerative gingivitis, Crater like lesions, Spontaneous bleeding

INTRODUCTION

Acute necrotizing ulcerative gingivitis (ANUG) is a painful type of gingivitis characterised by gingival pain, bleeding, and interproximal papillomacular necrosis. In 1896, Plaut (Barnes et al., 1973)[1] and Vincent described ANUG for the first time. Military historians have documented a condition characterised by painful, bleeding gingival tissues, necrosis, and fetor oris for centuries. This oral disease was not scientifically investigated until the work of Plaut and Vincent in the 1890s. During World War I, it was named as "trench mouth.It has several names, including Vincent's disease and trench fusospirochetal gingivitis .This type of gingivitis is uncommon. Proliferating oral anaerobic bacteria play a role in the development of the disease's clinical signs and symptoms, possibly as opportunistic pathogens. Secondary predisposing etiologic factors such as stress, impaired chemotaxis, poor oral hygiene, alcohol consumption, smoking, general debilitation, and malnutrition have all been studied.

ETIOLOGY

The exact cause of ANUG is unknown, but it is thought to be a polymicrobial infection caused by normal oral cavity commensals. However, when the local resistance of the human gingival area is reduced, the organisms become pathogenic.ANUG is most commonly caused by an opportunistic bacterial infection and is mostly caused by fusiform and spirochete bacteria. Spirochetes and the majority of Gram-negative bacteria, including Bacteroides intermedius and Fusobacterium spp., were identified as the most common causes in one study.[1,2]Another study identified Treponema spp., Selenomonas spp., Fusobacterium spp., and Prevotella intermedia among the microbiota associated with ANUG. [3] Eventually, ANUG is linked to spirochetes and gram-negative bacteria, which can be identified using the gram stain if performed. [4]

EPIDEMIOLOGY

Some centuries ago, ANUG was well known in Europe and North America. ANUG was reported in these Western countries, particularly amon personnel from the military As early as 401BC,Xenophon[5] described a clinical entity that resembledANUG in his soldiers' mouths. Bergeron[6] described a similar disease entity in 1859.Among the French troops with whom he served. a select fewcases reported in the European literature Prior to its association with AIDS, it was most commonly found among military personnel in North America.[7,8] However, because HIV infection is so common, ANUG has become widely recognised as a lesion that is strongly pathognomonic of the infection, especially when seen in otherwise healthy young adult.[9,10]The prevalence of ANUG among HIV-infected patients has been reported to range from 4.3 percent to 16.0 percent.[10-12] In marked contrast, the disease is still frequently seen in developing countries, especially in SubSaharan Africa where it occurs almost exclusively among poor children usually between the ages sof 3 years and 10 years from low socio-economic backgrounds.[13,14,15-19]Similar findings have been reported in India. 22 In Nigeria, hospital-based studies conducted over the last decade indicate that the incidence of ANUG is increasing among children, with a prevalence of up to 23% in children under the age of ten being reported. [13,19,20] In contrast, the disease is still prevalent in developing countries, particularly in Sub-Saharan Africa.

PATHOPHYSIOLOGY

Psychological stress, poor diet, insufficient sleep, alcohol, tobacco, poor oral hygiene, pre-existing gingivitis, and HIV infection are all physiologic factors that contribute to ANUG. These factors have been shown to impair the host immune response, allowing bacteria to spread more easily. Psychological stress decreases gingival microcirculation and salivary flow while increasing adrenocortical secretions, both of which can alter the function of polymorphonuclear leukocytes and lymphocytes. This alters the patient's immune response as well as his or her behaviour and mood, resulting in poor oral hygiene, malnutrition, and increased tobacco consumption.[20] Similarly, a poor diet raises histamine levels and increases gingival capillary permeability, resulting in decreased PMN leukocyte chemotaxis. [20]

CLINICAL FEATURES

While some ANUG signs and symptoms appear to be pathognomonic for the disease, others appear infrequently. Perhaps the most widely used Interproximal necrosis is one of the agreed-upon signs8, with ulcération, pain, and bleeding in the affected area that the "classical symptoms" of Vincent's infection were [21] spontaneous interproximal haemorrhage without gingival redness and [22] inflamed papillae apices that bleeds easily without tenderness. They went on to say that the stereotypical CLINICAL description of interproximal destruction in Vincent's infection is not an unavoidable symptom [23].Schluger [24], on the other hand, provided the most widely recognised and accepted description of the pathognomonic signs of ANUG in 1943: This finding is supported by Barnes et al.8's large study (218 cases), in which gingival bleeding and interdental blunting or cratering were found to be the most commonly associated signs. Suzuki et al.[25]recently reported that all 35 patients they examined had interproximal cratering of the gingival papillae, 97 percent had foetid odour, 85 percent had pseudomembranous formation, and 76 percent complained of bleeding gums.

MANAGEMENT

Initially, treatment options for ANUG were nearly as numerous and diverse as its synonyms, but they all focused on reducing the bacterial flora. Vincent,In 1898, he described a treatment that included local iodine application and gargles with boric acid solution.consisting of potassium permanganate solution rinses, iodine tincture locally applied, and hydrogen peroxidePeroxide rinses and thorough mechanical debridement are both recommended.followed by the application of silver nitrate to the periodontal ligament sulci. Hirschfeld proposed treating gingival inflammation with frequent sodium peroborate rinses, thorough debridement, and no toothbrushing until gingival inflammation was reduced the following year. [23]Schluger[26]describes a streamlined treatment that consists of thorough, deep curettage followed by frequent rinses of diluted hydrogen peroxide or even plain water, primarily as a lavage.Fitch and colleagues report that immediate ultrasonic instrument debridement was highly effective in the treatment of ANUG, with rapid symptom relief and "remarkable tissue response." Goldhaber and Giddon12 agree with this approach to therapy, but they also advocate for the use of antibiotics, specifically penicillin, in the treatment of advanced cases. Gingivoplasty is thought to be important in preventing disease recurrence by removing the residual soft tissue craters.[27,26] Recent English dental literature supports the use of antibiotics in the treatment of ANUG, and researchers found metronidazole to be as effective as penicillin in causing remission of ANUG clinical symptoms in double-blind clinical studies. This is consistent with the findings of Loesche and colleagues, who reported that metronidazole treatment resulted in the immediate resolution of clinical symptoms. Clinical status improved in tandem with a decrease in the proportions of bacterial species associated with the disease.[28,29]

CONCLUSION

Over the years, there have been almost as many different ways to treat ANUG as there have been synonyms, but they all revolve around reducing the bacteria flora. The usage of the use of antibiotics in the treatment of ANUG has increased. It has been strongly urged. Metrondazole is a drug that is used to treat. It's also been discovered that it's just as effective as penicillin in treating infections.resulting in clinical symptom remission, and this occurred in tandem with a decline in overall of women in the workforce. The highly preventable ANUG, on the other hand, entails putting in place measures to combat malnutrition, improve oral hygiene, and improve overall health.minimising oral mucosa damage as well as keeping the oral environment free of contamination Bacteroidacease, particularly F. necrophorum, has a heavy load. Ulcerations of the oral mucosa and Traumatic lesions, such as traumatic tooth eruption, should be considered as having the potential to develop into ANUG. Furthermore, the prevention of water contamination due to faeces and weaning foods Another way to avoid this is to improve your nutritional status and practise good oral hygiene. This is a disease that is highly preventable.a list of bacteria species linked to the disease

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